WITH EIGHT PAGE SUPPLEMENT.

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Dynamos at the Paris Exposition.

The London *Electrical Review*, in an article on "Dynamos at the Paris Exposition," gives an interesting description of the machines manufactured by M. Fabius Henrion, of Nancy, France, shown in figures 1 and 2, and of the large four-pole generator of the Maschinen-fabrick Oerlikon of Zurich, shown in figure 3, from which we condense the following details. The Henrion machines are of the Schukert type, with disc armatures. The smaller incandescence lighting machines and those for arc lamps in series are made with two poles, as shown in Fig. 1, while the larger sizes for incandescence lighting have four poles, as seen in Fig. 2, or a greater number, depending on the currents to be carried. The armature core is formed by winding soft iron wire on a gun metal supporting ring. Between the adjacent layers strips of parafined paper are placed, practically dividing the iron of the armature into concentric ribbons, by the edges of which the lines of force enter. After being properly insulated with coverings of tape, the core is Gramme wound in the usual way. In the two-pole machine, Fig. 1, the magnets instead of being placed one directly above the other, lie at an angle of about 45°, an arrangement rendering the brushes and commutator easily accessible. When constructed for arc lighting, these machines generally give a current of 8 amperes, and are built for any differences of potential up to 1,000 volts. Machines of this pressure support 20 lamps in series, and have in their commutators 56 sections. Mr. Henrion uses two methods of regulator for keeping the current constant under a varying number of lamps, which are very neat. One is a mechanical device for varying the angle of the brushes on the commutator, and the other consists in varying the resistance of a shunt across his field coils.

As will be seen from Fig. 2, the current from the four pole machines is collected by two sets of brushes at 90°, the coils being cross connected by a series of brass rings placed side by side, which are insulated from each other and from the shaft, and from each a connection for diametrically opposite coils. For incandescence lighting these machines are generally compounded to 110 volts, two poles being used for currents from 10 to 112 amperes, and four poles from 150 to 350 amperes. For a current of 550 amperes six pole machines are employed, while a machine for 1,000 amperes would have eight poles and make 170 revolutions per minute.

The Oerlikon generator, shown in Fig. 3, running at 480 revolutions, transmits about 240 electrical horse-power at a difference of potential of 600 volts. The field is of cast iron and made in two parts, the lower part with two of the radial magnets being cast with the bed plate and the upper part with the two remaining magnets joined to it horizontally, as shown. The magnetic system may be said to consist of two single horse-shoe magnets with split yokes. The armature is of the ring type, built up of soft iron washers insulated with paper, and is wound Gramme fashion. The current is collected by four sets of two brushes each, each brush being about two inches wide, and, as opposite sets are connected in parallel, this gives four brushes for the collection of about 300 amperes. The magnets are series wound. Power is transmitted from this to a similar machine in the Swiss section, which, as a motor, drives a variety of machinery.

Report of the Executive Committee of the National Electric Light Association.

On account of the sudden adjournment of the Convention, there was some business left uncompleted. Among this was the report of the Executive Committee, which was as follows:

Your Executive Committee, appointed at the Chicago Convention, was so scattered throughout the country that it was found too inconvenient and expensive to have meetings of the entire committee; therefore, the various matters of interest were delegated to sub-committees, who have united to make this report.

One of the most important matters before the Committee was the establishment of permanent headquarters in the city of New York. The experiment had been tried a few months, and at the Chicago Convention it was ordered to be continued six months more.

Your Committee have moved the office from 23d street to the elegant Telephone Building, No. 18 Cortlandt street, in the center of the electrical business district, and convenient for both resident and non-resident members.

The work done by the Secretary at this office shows itself in the largely increased membership of the Association, and in the work of the various committees which have reported at this Convention. The Committee have no hesitation in saying that the success of a permanent headquarters has been in advance of their expectations, and earnestly recommend that the New York office be continued.

The volume of proceedings of the Chicago Convention has been made up in better form than heretofore, and the cloth binding changes the pamphlet which may be thrown into the waste basket to a book worthy a place in any library. Members have heretofore been limited to a single copy of the proceedings, but your committee have provided that hereafter further unbound copies to a reasonable limit may be supplied to members without charge, and the binding may be added to the current or previous volume at cost.

Your committee are glad to be able to present a good report as to the finances of the Association. The year 1888 closed with a debt of $1,800. This debt has been entirely wiped out with a single exception hereinafter referred to. The entire expense of the current year to August 1st has been paid. There are no outstanding bills, and a balance remains in the treasurer's hands of $910. The income of the Association for the calendar year will be over $5,200; the expense about $1,000 less. So that your committee can say with some confidence and much satisfaction that the Association is in a sound financial condition. There is, as just mentioned, one claim against the Association still unpaid. The amount is $259.60. This was incurred before the appointment of this committee; therefore, the payment is considered beyond its jurisdiction. There is no doubt whatever that it was incurred for the benefit of the Association, and your committee recommend that authority be given them for its payment. The preparation for this Convention has been part of the labor of this committee. The character of the papers presented is such that the report cannot but add to the growing influence of the Association.

* * *

BENJAMIN RHODES, Chairman.

THE OERLIKON GENERATOR, PARIS EXPOSITION.

IN THE MATTER OF THE CENSUS.

The following would no doubt have met the approval of the Convention had it not adjourned so suddenly:

We, the undersigned, a sub-committee of the Executive Committee appointed for the purpose, beg leave to report the following, as embodying the views of the Executive Committee:

WHEREAS, It is extremely important that the United States Census for 1890 should contain a special section for the Electrical Industry, and that the date for such section should be collected, tabulated and published in a thorough and systematic manner.

BE IT RESOLVED, That the National Electric Light Association, now in convention, respectfully request the Superintendent of the United States' Census for 1890, to provide a section for the electrical industry, and they would suggest that Mr. Allen F. Foote, of Cincinnati, Ohio, has proved himself to be well qualified to do this work, and that he would be a proper person to organize and direct it.

Signed, { EDWIN R. WEEKS. OTTO A. MOSES. T. CARPENTER SMITH.

AT NIAGARA FALLS.

The Opening and Proceedings of the Tenth Convention of the National Electric Light Association.

PRESIDENT WEEKS' OPENING ADDRESS AND HON. W. C. ELY'S WELCOME TO THE DELEGATES—THE WORLD'S FAIR COMMITTEE APPOINTED.

VALUABLE AND INTERESTING PAPERS—BUSINESS TRANSACTED—THE EXHIBITS AND WHO WERE WITH THEM—NOTES AND STRAY ITEMS FROM THE CONVENTION HALL—KANSAS CITY NEXT MEETING PLACE.

TUESDAY'S PROCEEDINGS.

FORENOON SESSION.

The Convention was call to order Tuesday, August 6, 1889, at 10.30 A.M., by President Weeks, in the Casino Theater, Niagara Falls, N. Y. Mr. Weeks addressed the Convention as follows:

Gentlemen:—We are met, primarily, to further the interests of local companies; secondarily, to aid in the general development of the business and to promote the good of manufacturers of electrical apparatus and supplies. Our association combines both the commercial and scientific elements, and its deliberations are of a theoretical as well as of a practical nature. Our chief work lies in calling attention to the needs of the business and to available improvements.

In this Convention are represented industries which embody the very fore-front of progress, yet many of you come from lands where electric light and power interests have no legal status, or are struggling under adverse enactments. I trust that the work of the Committee on State and Municipal Legislation will be so seconded that we shall soon be accorded just legal recognition.

While the arc light business is steadily increasing, the greatest development has been, and must continue to be, in other directions. The superiority of the incandescent light as a supplement to the arc is now more generally acknowledged; but owing to the commercial value of the residual products in the manufacture of gas, the incandescent light cannot compete with it in the matter of price. Without a perfect subway system and storage battery it cannot be so reliable.

The Committee on Underground Conduits and Conductors will report progress and ask for more time.

It should not be inferred from the absence of this topic from our programme that its importance has been overlooked or that nothing is being done in the direction of electrical subways. Hundreds of thousands of dollars are being expended in experimental work, but many years must elapse before a complete solution can be reached.

The outlook for the alternating current is encouraging. More exact work is being done in this direction; and the invention of meters and motors for this current has added greatly to its commercial value. The meters recently brought out should be of the greatest advantage. It is a fundamental principle that every business of any stability measures its commodity, and customers are more confident of their service when they know that it is being measured.

We may feel gratified that our electrical apparatus is in demand in foreign countries, but this should not blind us to the fact that the criticisms of European engineers upon our streets and station construction are just. It is a hopeful sign, however, that both local and parent companies are paying more attention to good apparatus and the proper construction of lines and planning of sta-

tions. This becomes more necessary as business increases and the price of coal advances, rendering a reduction in fuel all important. The increase in boiler pressure and the compounding of engines are steps in this direction. Schools, colleges and the larger electrical companies are paying more attention to electrical education. Popular articles on the applications of electricity are informing the general public as to the extent and value of our industry. With greater efficiency in apparatus, better trained men and more intelligent management, depreciation will be reduced, the conservatism of investors toward electrical securities will disappear, and capital will seek us.

Probably no other topic upon our programme will attract more general attention than the "Unconstitutionality of Electrical Execution." Whatever may be the opinion of scientists in regard to this mode of taking life, the whole movement is encouraging in that it evinces the world's progress in sensibility.

One of the most important questions that will engage your attention at this session will be the report of the Committee on Harmonizing the Electrical and Insurance Interests. It is a matter of deep concern, not only to the producer, but to the consumer of electricity, that the electrical and insurance companies co-operate. To harmonize these interests will be to give one of the strongest impulses to electrical industries.

Electric welding is winning its way to a commercial basis, and is destined to occupy an important place in mechanics. But by far the greatest activity at present is in the direction of the transmission of power. The electric motor is working a complete revolution. It is impossible to forecast its future. The field of the stationary motor is practically infinite, and is almost virgin soil, while the mileage of railroads now operated by electricity, though rapidly increasing, is still so small, compared with the total railroad mileage, as to barely suggest immense possibilities.

Statistics collected by our secretary show that the number of arc lamps in service in the United States alone during the last six months has increased from 219,924 to 237,017; that of the incandescent lamps from 2,504,490 to 2,704,768; the number of street railroads operated by electricity is now 109, comprising 575 miles of track and 936 motor cars. The capital now invested in these industries amounts to $275,000,000.

These facts bring most forcibly to our attention the financial importance of the interests which we are here to represent, and should impress deeply upon the mind of each member his individual responsibility and the necessity for doing his utmost, both by regular attendance and close attention to the work in hand, to accomplish the objects for which we are assembled.

At the conclusion of his address, the President introduced Hon. W. C. Ely, of Niagara Falls, who delivered the address of welcome, as follows:

Mr. President and gentlemen of the Convention—To me has been delegated by the chairman of your Executive Committee the agreeable duty of extending unto this Convention a welcome greeting on the part of the citizens of Niagara Falls.

It has been customary from ancient times for communities to receive with honor and evidences of pleasure, persons of high rank or distinction visiting within their walls. The onward sweep of civilization has demolished walls and battlements, and the stranger enters at will the cities and towns of enlightened countries; but a modification of ancient customs still requires that a distinguished collection of guests visiting in a semi-public capacity shall receive from the community honor and suitable recognition. So I bid you welcome to Niagara Falls.

Indeed, you are very welcome. We have looked forward eagerly to the assembling of this Convention as an occasion fraught with interest and benefit to our locality. You are here; we hope you will do us good, and Niagara cannot but benefit the members of this Convention.

The scenery of Niagara Falls—the Mecca that attracts travelers from all over the world—is now in its splendor; and it shall be part of my duty this morning, at the beginning of your visit, to endeavor to assist you somewhat in your enjoyment of the scenes of nature that await your inspection. Perchance the most of you have seen the Falls, it may be more than once, but how few of the thousands who come and go to view Niagara get a full realizing sense of the beauty and grandeur of the cataract and its accessories, only constant and close observers can tell. Some knowledge of the geology and history of the cataract and vicinity is necessary to excite in one to the fullest extent those emotions without which the fullness of appreciation of this great product of nature's forces can never be realized.

You are experimenters with power and force, you deal in it, you generate it, utilize it and profit by it. The item of profit is a stimulus to your brains and energy. You are the devotees of a force, the latest, the most interesting, to which all thoughtful men are now looking for the solution of some of the most difficult economic questions of the hour. To you then will appeal in all its grandeur, this mighty waterfall, the grandest manifestation of physical power upon the face if the globe. As such it is most interesting, most wonderful. Niagara is beautiful, but other places compare with Niagara in beauty; but as an exhibition of merciless, irresistible power it is stupendous, overpowering, and the only feelings akin to those with which in the gorge below one gazes upon its madly falling waters are those inspired by the sight of the waters of the ocean, when, from the hurricane deck of a storm-driven vessel, wherever the eye may reach, it falls upon the angry waste of waters, stormbeaten, tempestuous and threatening. As an exhibition of wild, untrammelled power the cataract and rapids will most affect you.

The accepted geological explanation of the formation of the Falls is wonderfully interesting. Your attention will be called to it irresistibly by the thought which occurred to my mind the first time I ever descended into the chasm below the Falls. How could this have been hollowed out? This is not the ordinary flowing of a river between natural boundaries; there has been something unnatural here. A giving way before the attacks of some force against which the mighty walls of rock deep laid by nature have rebelled in vain, and such has undoubtedly been the case.

If there ever was a time when the mountain barrier at Lewiston, six miles below this place, stretched across unbroken from east to west, there were then no river and no Falls, but the waters of Lake Erie covered the place where this building now stands, and for centuries its fretting waters were restrained by the natural barrier of the ridge just mentioned. Then there was no union with Ontario's waters, and through the Des Plaines or the Calumick river into the Illinois the waters of all the upper lakes found their way into the Mississippi and the Gulf.

That this was the case is easily demonstrable. The lake surveys show that the surface or water level of Lake Michigan is only 30 feet higher than the waters of Niagara River at Gill Creek, just east of the rapids above the Falls. The water in the Des Plaines and Calumick rivers is only 11 to 12 feet above the level of Lake Michigan, so that a barrier across the Niagara 60 feet high would have sent the waters of the lakes into the Illinois. This barrier existed in the ridge at Lewiston 60 feet high and more than two miles wide. Against that barrier for centuries must have dashed the wind-driven waters of Lake Erie, then more forcible because of their greater volume, until at last some terrific wind storm raised some mighty tidal wave and, hurling it against the barrier, weakened and narrowed by continued erosions, it surmounted the obstacle and the waters denuded the top of the ridge of its gravelly deposits and swept over into the lowlands beyond. Continued washings followed, and the disintegration of the rocky barrier was assisted by the action of the frost, air, and the action of the ice, until finally a channel was excavated lower than the waters above, and the cataract was begun. From that time to the present the ceaseless action of these great forces has continued, and the thunder of the mighty cataract has rolled down the corridors of the centuries, while it has receded southwardly through seven miles of solid rock.

Such is the past of this wonderful water fall. With what feelings of interest we speculate upon its future.

See the Falls and rapids again and again; by sunlight and by moonlight. There is no more interesting place, none with scenery more diversified. From the crowd in Prospect Park in five minutes walk to the center of Goat Island, you may, in the words of Bryant,

"Lose thyself in the continuous woods where rolls the Oregon, and hears no sound save its own dashings."

The history of the vicinity is fraught with interest to the sightseer. Along the banks of the Niagara the fierce and cruel Senecas waged unrelenting and exterminating war against the more docile "Neutral Nation," and from the time that the Chevalier Robert de la Salle entered the mouth of the river to the close of the war of the revolution the shores of the Niagara were dark and bloody ground. Five miles above this place La Salle, in 1679, built "Le Griffin," a vessel of 45 tons, the first sailing vessel that ever navigated Lake Erie. The French traders of the latter part of the 17th century, coming from Montreal across Lake Ontario, entered the river at Fort Niagara, landed their boats at Lewiston, and with incredible toil carried their goods over the portage from that place to the river two miles above this place. Along that portage, half way to Lewiston, in the French and Indian war, a band of the cruel Senecas massacred two companies of English soldiers guarding a passing supply train, and but three persons escaped alive to relate the horrid details. Above the village stood Fort Schlosser and the French fort Du Portage; across the river are the battle fields Chippewa and Lundy's Lane, and crossing the height opposite Lewiston, the lofty monument that marks the spot where fell the valiant Brock in the battle of Queenstown Heights.

But it is not merely as a natural wonder, not merely as a thing of grandeur and beauty that you will look upon Niagara. For years the minds of power producers have been turned with longing towards the mighty cataract, and with the rapid advancement lately made in the development of electrical power, there seems to have been a corresponding increase of interest in the capacity of the Falls, and from all over this country and all parts of Europe have come within the past three and a half years the suggestions, plans and schemes of all classes of men for the utilization of the power of the Niagara River. It has been suggested to me by the list of subjects of papers to be read, that some considerable part of the time of this body would be given to the consideration of water power in connection with electricity. And what more fitting topic could be chosen? Is it not true that the successful manipulation of electricity as a force for distribution is dependent in a great degree upon our ability to devote water power to its production? It seems to me it is so. The manager of one of the great lighting companies of a large lakeport city recently estimated that it cost his company for coal $40 per horse power per annum. This granted at Buffalo would be true elsewhere. How greatly to be desired then becomes a steady, unfailing water power, costing in *toto* say from $10 to $15 per horse-power per annum.

So firmly am I of the opinion that the successful use of the electrical force is dependent largely upon increased facilities of water power, that I believe we shall ultimately see all over this country immense reservoirs constructed in the mountain ranges where our large rivers and streams have their head-waters, and by means thereof, available water power for electrical uses all over this country. Not structures like the fatal dam on the Conemaugh, but safely and securely built by the best engineers, they will prove more magical far than the lamp of Alladin, sending forth a stream of effulgent light into all the dark places, and supplying to man a helper more economical and easily used than even steam, heretofore man's greatest aid in his contention with the mighty obstacles of nature to the advance of civilization. If this be true, of how great interest to science and the world is the solution of the problem of the utilization of the furious, unbridled torrent of Niagara.

A plan has been formulated which solves the problem successfully. A rapid sketch of it would be understood quite thoroughly if the listener has in mind the topographical features of the river immediately below the Falls, and above them for a mile or two. But let me assist you in grasping the situation: To the eastward of the village for several miles the land is nearly level with the waters of the river which there move slowly in a broad body; then the rapids succeed, and then the plunge at the Falls, 160 feet; and below, the chasm, 200 feet deep. From the water level in the chasm below the Falls it is proposed to excavate a tunnel 24 feet in diameter, extending under the village eastwardly at an ascending grade of one foot in 100 feet, which tunnel will approach within 400 feet of the river just east of the present hydraulic canal, and at that point will be 125 feet below the surface of the land and the waters of the upper river; thence it will extend eastwardly with a slightly modified grade and parallel with the river about 1½ miles, and at its easterly termination will still be 90 feet below the surface, and in diameter 10 feet, the same having been gradually narrowed to that limit in the last 1½ miles of its length. This tunnel will serve as a tail race simply to discharge water. Immediately over and above this tunnel will be constructed lateral tunnels at right angles with the river and the main tunnel, and arranged to discharge into the latter. Over and above the lateral tunnels, and like them at right angles with the river and the main tunnel, and upon the surface of the land, will be excavated surface canals, into which will be diverted the waters of the river. By the side of these canals wheel-pits can then be excavated, and into them turbine wheels placed at a depth of 100 feet below the surface of the land, and arranged to discharge directly into the lateral tunnels below; and thence through the main tunnel or tail race and into the gorge of the river below the Falls. This system of transverse canals and tunnels would discharge 864,000 cubic feet of water per minute, and furnish 119,000 horse-power; and this power is not situated in the midst of inaccessible mountain ranges, but midway between New York and Chicago, on the great trunk lines of railroads, with unsurpassed shipping facilities.

The advantages of the situation are apparent at a glance. As enumerated by Thomas Evershed, the originator of the tunnel idea, and summarized by a very high engineering authority in his endorsement of Mr. Evershed's plans, they are: An exhaustless supply of pure water at a practically constant head, solid and durable rock containing all the tunnels, shafts and conduits, and furnishing solid and imperishable foundations for all the structures, and a practically uniform surface of the proper elevation of the lands necessary for manufacturing structures.

At Niagara Falls then is nature's great storehouse of power for the development of electricity and the successful answer to the question, What can be done in the transmission of power by electricity to a distance?

Sir William Thomson said that "Niagara Falls possessed more power than all the coal mines in the world." And a true appreciation of the idea impelled Edison to say that "Niagara is the greatest storage battery in the world."

This latter is absolutely truthful, and with the power of the waterfall developed by means of the hydraulic tunnel; a system of powerful dynamos to transform the water-power into electricity and this transmitted to Buffalo, that city might be supplied with light and power far more cheaply than at present, and the demonstration of the capabilities of electrical power and transmission afforded that would give us something more sure than the world has as yet had.

The accomplishment of this work would solve the problem of rapid transit in the City of Buffalo.

Niagara Falls would then become the center from which, after the perfection of the storage battery, electricity for furnishing power all over the eastern part of the continent would be daily shipped by the train load. And here at Niagara would then be inaugurated a series of experiments in this still mysterious force which would be productive of the greatest economic results.

I speak of experiments. You will pardon me, but it seems to me that the knowledge of this wonderful fluid, if fluid it be, is largely experimental and scarcely exact. Indeed it appears that the most scientific are not always most successful. It remained for a farmer near North East, so the daily papers say, to discover the means of utilizing a single wire simultaneously for telegraphic and telephonic purposes. And the bucolic inventor has evolved a dry battery which is to cheapen materially the operating of the telephone. This will interest you as stockholders on account of increased dividends. Consumers are not so green as to expect any reduction of rates. What I mean was well illustrated the other day at the close of the judicial investigation had for the purpose of ascertaining whether it was safe and humane to delegate to this subtle agent the functions of the public executioner, when the lawyer opposed to it in that capacity, said to a witness, "Ah, then you know as much as men generally do about it, do you? Well, that's more than the experts know." I hope Mr. Moses will help this Convention out on this subject with his valuable paper.

Gentlemen, you now know why this town and its people are particularly glad to see you. We feel that you are to be interested in our projects and that from you we are to receive assistance. Niagara Falls has for years lain asleep by the side of the greatest mill dam and water-power in the world, and she is now awakening to a sense of her misused or non-used power. Your aid will be valuable to her and her power of the greatest value to the electrical world. While you are here we hope you will enjoy every moment. And again, gentlemen, I assure you that you are most welcome to Niagara Falls.

The roll was called by the Secretary, who then read the following communication:

MAYOR'S OFFICE,
NEW YORK, July 17th, 1889.

Dear Sir:—I request your presence at a conference of representative citizens, to consider the advisability of holding an international exposition at New York in 1892, and to arrange for the preliminary work if it is deemed advisable. I hope you will be kind enough to attend at my office on Thursday, the 25th of July, at 3.30 o'clock.

Truly yours,
HUGH J. GRANT,
Mayor.

The President: I greatly regret that I could not attend the meeting, and I hope the Association will take appropriate action on Mr. Lynch's resolution, now in the hands of the Executive Committee looking towards the co-operation promised Mayor Grant in my answer to the invitation with which he honored us.

Mr. A. J. De Camp, of Philadelphia: I move that the question of appointing a committee to co-operate with Mayor Grant in the carrying out of the project to hold a World's Fair in 1892 be referred to the Executive Committee.

Mr. J. F. Morrison, of Baltimore: I do not think it would be good policy to refer any-

thing to the Executive Committee which belongs to the Convention. I believe that this matter ought to be acted upon in open Convention; and, with all respect to Mr. De Camp, I suggest that he withdraw that motion until the afternoon session.

Mr. De Camp: It was my aim to have that come before the whole Convention, but simply to refer it to the Executive Committee to formulate and report to the Convention.

Mr. Morrison: Very well, if your motion is so amended.

Mr. F. E. Degenhardt, of Chicago: I wish to know if we are to commit ourselves to holding the World's Fair in New York. It strikes me that Chicago is in the field for this Fair, and I would like, on behalf of the Mayor of Chicago, Mr. Cregier, to submit for your consideration a proposition from our mayor looking to that end. I suppose, however, it will be the province of the Committee to consider that matter.

The President: As we have no communication from Chicago, it seems to me that Chicago is about to be left on this measure. (Applause.) And let me suggest that there is a Chicago man on the Executive Committee.

The President put the motion as follows: That this question be referred to the Executive Committee, who will report to the Association in Convention at some subsequent session.

Mr. Morrison: At the beginning of the afternoon session.

The President: At the beginning of the afternoon session.

Mr. H. W. Pope, of Elizabeth, N. J.: The Committee take no action upon the resolution.

The President: None whatever. It comes before the Convention for action.

The President put the motion, and declared it carried.

Mr. Rhodes: On behalf of the Executive Committee, I wish to make one or two announcements looking to the pleasure of the members of the Convention and their friends. After business is over this evening, the members are invited to attend an excursion, which will leave the New York Central Railroad depot at seven o'clock, going down the river to Lewiston by the excursion train, in view of the Rapids, and taking the boat at Lewiston and going down the river for a short moonlight ride. Those who have taken this trip know that it is a very pleasant one, and those who have not taken it may be assured that if the evening is as pleasant as it bids fair to be, the trip will be worth the trouble. It is necessary to say that the train will start at 7.15, and it is requested that all those who take part in this excursion be promptly at the New York Central Railroad depot at 7 o'clock, so that they may be on the train in time, and that there may be no delay. The track from Niagara Falls to Lewiston is a single track, over which trains run very frequently for the purpose of viewing the scenery, and it is necessary, in order not to delay the trains, that they start promptly at 7.15. No ticket will be necessary, and it is requested that those who wish to go and to take their friends, will make it known to their friends that the excursion is for their benefit.

To-morrow evening there will be a reception and promenade concert at the International Hotel, to which all members of the Convention and their friends are invited.

The Executive Committee will meet immediately after the close of this session at Parlor A, International Hotel.

It was moved and seconded that the Convention adjourn to 2.30 P. M.

Mr. Fred H. Whipple, of Detroit, Mich.: At Chicago time or New York time?

Mr. Rhodes: New York time. The limits of Chicago don't quite take in this place yet. (Laughter).

The President put the motion and declared the Convention adjourned until 2.30 o'clock, P. M.

AFTERNOON SESSION.

The Convention was called to order at 2.45 o'clock by the President, who said: Owing to the fact that the Secretary's baggage has gone astray, we will have to shift from the regular topics. We will, therefore, now hear from Chairman Rhodes the report of the Executive Committee.

Mr. Rhodes: Your Committee is a large body, and, as you know, large bodies move slowly. The Committee had a formal meeting at Chicago at the close of the last Convention, and the next meeting of that Committee was held this morning. A large amount of the business of the Association was delegated by that Committee to subcommittees formed of its members, and much of that work has been done, and well done. Those sub-committees have only reported this morning, and it is necessary, as has been customary at this Convention, that the Executive Committee should wait until later in the proceedings before presenting its formal report; but at the meeting held this morning a matter was brought up which was referred to the Association in convention assembled. That was the invitation of the mayor of the city of New York to this Convention to appoint a member who should act in conference with his honor, the mayor, in reference to the proposed Exposition in New York in 1892. I am instructed by the Executive Committee to state that this resolution had been passed by the Executive Committee:

RESOLVED, That this Executive Committee recommend to the Association that the President be authorized and directed to appoint a committee of five members on the pending International Exposition to be held in 1892, whose chairman shall represent this Association on the Conference Committee called for by his honor, the mayor of New York City, to aid in making the Exposition a success.

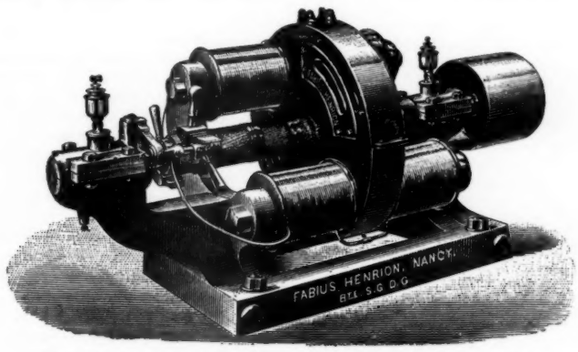
On behalf of the Executive Committee, I move that the resolution be adopted, and that the instruction be carried out—that the President appoint a committee of five members.

Mr. Degenhardt: Before accepting the resolution as offered by the Executive Committee, I would like to state that I have in my hands a telegram from Mr. J. P. Barrett, of Chicago, in which he says he is sending a telegram asking the mayor of Chicago to request that a committee be appointed to co-operate in the efforts towards holding the World's Fair in the city of Chicago. I desire to offer as an amendment to the resolution offered, that it be the sense of this meeting, and that the President so instruct Mayor Cregier, of Chicago, as well as Mayor Grant, of New York, that we accept their kind offer with thanks, but at this early day where the entire matter is problematical, it is utterly impracticable to declare ourselves in favor of either city. If we declare at all, let it be Chicago. (Laughter.) Why not Chicago as well as New York. I am not in favor of going on record with my vote in favor of that resolution, except as amended. I move that as an amendment to the resolution.

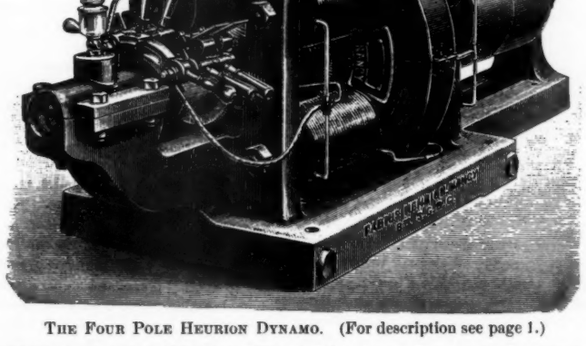
Mr. Rhodes: Mr. Chairman, in order to postpone or entirely put off a matter which may possibly come up here and take the entire time of this Convention this afternoon, as it took the time of the Executive Committee during almost the entire interim of the morning session, I will state how this came up in the Committee. The question was raised whether this Association should commit itself to a World's Fair in 1892 at New York, in opposition to a World's Fair in 1892 at Chicago, Washington, or some some other city, and the Executive Committee decided that it could not take ground on that point—that it is not best at this point to commit itself in favor of any city. But on this question we decided that we had before us an invitation from the mayor of the city of New York to appoint a man, not to forward, understand—not to vote for a World's Fair in New York City, but simply to accept a courteous invitation from the mayor to appoint a man from our Association to meet with them as a Committee of Conference. I hope this matter will not come up for discussion between the cities of New York and Chicago or any other cities, but that it may be treated simply as a courteous invitation to which we are returning a courteous answer.

Mr. W. A. Kreidler, of Chicago, Ill.: It seems to me that the report or resolution is not worded so as to express exactly what the Committee means. Now, it is a fact that when they went into session they only had a communication from the mayor of New York, but it seems to me that we must now take into consideration the mayor of Chicago, and I think the wording should be changed so that there will be no doubt about its meaning, and about the willingness of the Association to co-operate with either mayor of the cities who have addressed an invitation to us. I do not think it is a question between New York and other cities, but

(Continued on page 7.)



THE HEURION TWO POLE DYNAMO. (For description see page 1.)



THE FOUR POLE HEURION DYNAMO. (For description see page 1.)

Harrison, O.—The Home Electric Railroad Company, Harrison Township, Montgomery County; capital stock, $50,000.

Oshkosh, Wis.—The Electrical Improvement Company, of Oshkosh; capital stock, $150,000; incorporators, Anthony B. Ferdinand, Chas. Nevitt, Curry C. Chase and John W. Hume.

Chicago, Ill.—The Archer Electric Battery and Appliance Company, of Chicago; to manufacture, buy and sell, and deal in medical electrical appliances; capital stock, $4,500; incorporators, E. A. Hutchins, Charles S. Burton and J. Elliott.

Chicago, Ill.—Pratt Electro-Medical Company, of Chicago; for the purpose of buying, selling, manufacturing and dealing in all kinds of electric-therapeutic and electro-therapeutic goods and appliances; capital stock, $100,000; incorporators, Harry P. Pratt, Samuel S. Parks and Eben F. Runyan, Jr.

Covington, Ky.—Articles of incorporation have been filed in the County Clerk's office by the Citizens' Electric Light and Power Company. The capital stock is $60,000. The incorporators are John R. Coppin, Archie Stewart, A. M. Worthington and W. F. Hays. The purpose of the incorporators is to establish a plant in this city to furnish electric light and electric motive power.

Detroit, Mich.—The Short Electric Railway Company, with a capital stock of $1,000,000, filed articles of association. The incorporators are Wells W. Leggett, of Detroit; Sidney H. Short, Charles J. Tracy, George W. Stockley, C. F. Brush, J. Potter and the Brush Electric Light Company, of Cleveland, and N. B. Abbott, of Columbus, Ohio. The company will equip electric railways. Half the capital stock is paid in.

Gloversville, N. Y.—The Gloversville Electric Company, formed for the purpose of manufacturing and using electricity for producing light, heat and power, and storing, etc., electricity for the purpose indicated, has been incorporated. The capital is $60,000, divided into $100 shares. The trustees are Edgar A. Spencer, Charles E. Sweet, W. H. Rupert, J. F. Van Ness, James Radford, Simeon L. Phillips and Francis H. Leonard, Jr. Operations are to be carried on in Johnstown and Gloversville.

Spokane Falls, W. T.—A. M. Cannon, Paul F. Mohr and Charles J. Smith, organized the Union Depot Company, of Spokane Falls, with a capital stock of $500,000, to conduct the business of a railway terminal company at Spokane Falls, and to construct, maintain and operate telegraph and telephone lines in Spokane County. Anthony M. Cannon, John R. Allen, Charles J. Smith and Edward Lyons have been named as trustees to manage the business of the company until December 10, 1889. The articles provide that they may have an office in New York City.

London, England.—S. Humbird, assistant general manager of the Westinghouse Electric and Manufacturing Company, has returned from England, where he completed the organization of the Westinghouse Electric Company, of London. The English Company acquire the patents, good will, business and property of the American Company known as the Westinghouse Electric and Manufacturing Company, of Pittsburgh. The company will manufacture and deal in every kind of engine, machine, wire, lamp or appliance capable of being used for the generation of electricity. The board of directors is composed of Sir H. W. Tyler, M.P.; Francis Pavy, John Dixon Gibbs, William D. Oyley, C. Colin Macrae, H. Rudolph Laing, H. Turton Norton, G. Westinghouse, Jr., and S. Humbird.

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We invite correspondence from Electricians, Inventors, and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, AUG. 17, 1889.

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Two or three valuable papers read at the meeting of the National Electric Light Association last week will appear in our next issue.

The Worcester, Mass., Polytechnic Institute has fallen into line with other institutions of learning in the establishment of a course in electrical engineering, the official announcement of which has just been made. The new department includes a one year course, leading to the degree of bachelor of science in electrical engineering. It is open to graduates of the Institute in the department of mechanical engineering, and others with equivalent attainments. The tuition is $150, and the laboratory fee, $20. Three testing rooms, each 60x25 feet, a battery room and dynamo room, together with the magnetic laboratory, afford accommodations for the work of the department.

The annual convention of the Edison electrical interests is in session at Niagara Falls, Tuesday and Wednesday of this week.

The action of the Electric Club in its choice of representatives for the committees of the World's Fair must meet with widespread approval. Both the gentlemen selected to serve are widely known in the electrical field, and are thoroughly competent for the important duty of the position.

The report comes from Denver, Col., that the final adoption of electric power by the Denver Tramway Company was directly due to the conversion of some of the leading stockholders after visiting Boston and other eastern cities, and obtaining ocular evidence of the perfect success of the systems there in use.

Mr. Max J. Becker, president of the American Society of Civil Engineers, shows a progressive and appreciative spirit by his remarks on the future of electricity in a recent address to the Society. He lays particular stress upon its usefulness as a lighting agency in subterranean or subaqueous operations. In the sinking of caissons, which is an important line of work for the civil engineer, the employment of incandescent lighting removes the risks and inconveniences incident to the ready and rapid combustion of inflammable substances under the influence of high atmospheric pressure.

If the Mayor had selected as representative of the electrical industry the first name—that of Theo. N. Vail—in the Electric Club list of two, as it was announced he would do, there would have been general satisfaction in electrical circles; and in addition as representative of the electric light and power interests of this country the gentleman, Dr. Otto A. Moses, named by the National Electric Light Association in response to an invitation from the Mayor to the President of the Association, this great and far-reaching branch of the industry would have been represented—and the two names would have been none too many. But he leaves this great industry and all its branches unrepresented, which is a mistake that should be promptly rectified.

A more terrible accident than that which occurred at Buffalo last week when an exploding naphtha engine killed and wounded several of a pleasure party about to embark for an afternoon sail, is seldom chronicled. While electricity and electrical power are being so thoroughly appreciated as to have no need of profiting by the shortcomings of other power agencies, still, in view of the general clamor in the daily press as to the dangers of electricity when any one carelessly and heedlessly touches a wire which he has no business to touch, and thereby is shocked more or less seriously, it is not out of place to call attention to this danger which threatens the users of naphtha engines. The comparison between this deadly machine and the electric motor fed by storage batteries and perfectly applicable to the same use, speaks for itself, not to mention the doing away with disagreeable odors, heat and labor, which the substitution accomplishes.

Several years ago an electric railway was put in at Denver, Colo., on the plans and system of a local inventor, and after some time spent in experiments, which were not entirely successful, the project was abandoned. During the time it was in operation, or that the current was on, to speak more properly, perhaps, several accidents occurred, horses received shocks and in other ways, and quite naturally, the prejudice of the Denverites was aroused against this form of street locomotion. But that was years ago, and it can only be ignorance which causes a Denver paper in a recent issue to say that "there may be such a thing as a successful electric railway system, but it had better be tried in the suburbs." The Denver editor should take a trip East, and by coming only so far as Omaha he will find that electric roads are past the experimental stage, and while they are fully good enough for the suburbs, the suburbs are not good enough for them, but they keep right on into the hearts of largest cities and win highest praise on every hand.

THE NIAGARA FALLS CONVENTION

A very interesting and most valuable literary programme was presented at Niagara Falls last week. Chairman Rhodes, of the Executive Committee, is to be congratulated. The addresses were of a high order, practical and scientific, and worthy of the space we give to them in this issue of the REVIEW.

The proceedings, with the exception of the undignified ending, were timely and intelligent. The forceful handling of the electrical execution question will, we think, prove of much potency in securing the repeal of this obnoxious law. The resolutions in relation to the World's Fair, to the duty on copper, to harmonizing electric lighting and insurance interests, etc., were indicative of the alertness of this Association and of the close watch kept upon the progress of affairs.

In the adoption of the new constitution the Association is placed on very nearly the same basis of control as that with which it began. It is unfortunate that the adoption was accomplished in the unfair way it was, as was also the selection of the place of the next meeting. President Weeks and his prompter and acting chairman, Mr. Morrison, of Baltimore, are placed in the unenviable position of securing their ends by means of unjust, inconsistent and unparliamentary decisions. To do this in the name of the central station men as opposed to the associate members was without the slighest authority, for the REVIEW has yet to meet the central station representative who favors the actions of the presiding officers the last Convention day. There were scarcely any objections to the proposed constitution—a few amendments were to be presented for discussion—and had Mr. Weeks been wise and just he would have permitted this discussion. In deciding that the constitution had been adopted when nearly everyone supposed, as it had been announced, that it had been received subject to amendment; and in deciding that it took effect at once so as to rule out the majority voting against Kansas City, President Weeks very naturally raised a storm.

Becoming frightened, he called Mr. Morrison to the Chair, passing over First Vice-President De Camp, who was present. Mr. Morrison ruled that an appeal from the decision of the Chair was out of order; also that a standing vote was out of order on a question in which his decision was evidently on the side of the minority, and then adjourned the Convention.

The REVIEW thinks the new constitution a very good one, and that the most appropriate time to hold a convention at Kansas City is while Mr. Weeks, a resident of that city, is president; therefore, it has no fault to find with the result in this respect; but along with four-fifths of the members of the Association it objects to seeing the proceedings made a ridiculous farce and the best friends of the Association treated with conspicuous disrespect and made the victims of trickery.

We are pleased to see that the Executive Committee is able to make such a favorable report in the matter of permanent headquarters. An Association of the size and influence of this one should very properly have an abiding place, and a year's trial has proven the plan a practicable one. Secretary Garratt has been a most indefatigable worker, and along with Chairman Rhodes is to be congratulated for the excellent programme presented, as well as the success of his special train from this city to Niagara Falls.

The REVIEW hopes to see a large attendance at the Kansas City meeting six months hence, and the gain in Western members equal the predictions that have been made.

A report comes from Maryland, that at Laurel, in that State, where the Weems electric railway system is being tried on an experimental track, a recent speed test was made, showing a rate of over two miles a minute, and this on a track with grades. Quicker transportation for mail matter and packages, at least, may be looked for shortly, and the result will be accomplished by use of electricity.

List of Delegates and Visitors at the Niagara Falls Convention.

Among those present at the Convention were:

Ackerman, P. C.	New York
Alexander, P. H.	Boston
Alexander, F. E.	"
Anderson, H.	Davenport, Ia.
Anthony, W. A.	Manchester
Atkinson, E. P.	New York.
Austin, G. L.	Boston
Alderson, F. S.	Hulberton, N. Y.
Allan, J. B.	Chicago
Allen, G. D.	New York
Almsted, J. A.	Rochester
Babcock, E. L.	Cuyahoga Falls
Babcock, C. A.	"
Barthmann, A.	New York
Barton, S. E.	Boston
Barney, H. T.	New York
Ball, F. H.	Erie, Pa.
Barker, F. E.	Boston
Bass, J. H.	Ft. Wayne, Ind.
Baird, M. E.	Windsor, Conn.
Beetle, G. L.	Chicago
Besse, L. W.	Springfield, Mass.
Besse, H. R.	New Haven
Blackwell, E. D.	Montpelier, Vt.
Blair, Elmer	Albany
Brady, T. H.	New Britain, Conn.
Burns, P. C.	St. Louis
Botsford, C. R.	New York
Brooks, F. A.	Dayton, O.
Buell, M. A.	Buffalo
Belote, J. C.	Norfolk, Va.
Blake, S. M.	Elmira
Bender, H. H.	Albany
Brown, C. A.	Chicago
Bradley C. S.	Yonkers, N. Y.
Bache, W. H.	Jersey City, N. J.
Bloomington, J. S.	Chicago
Bates, M. E.	Kansas City, Mo.
Black, C. H.	New Orleans
Butler, Wm. J.	Lockport, N. Y.
Calvert, W H.	Cincinnati
Castle, W. W.	Boston
Candee, W. L.	New York
Coggeshall, H. F.	Fitchburg
Coleman, R.	New York
Corey, R. B.	"
Cone, C. H.	Ansonia, Ct.
Cram, W. B.	New York
Crawford, F. A.	Boston
Crouse, J. B.	Cleveland
Curtiss, C. C.	"
Cullen, Wm. F.	New York
Cutter, George	Chicago
Cooper, Thos.	Toronto
Cole, L.	Peoria
Corey, C. H.	Geneva, N. Y
Culver, W. S.	Cleveland
Cooke, H. E	Cincinnati
Cox, S. E.	Cleveland
Cram, Henry B.	Boston
Darrin, D. H.	Buffalo
Daniels, A. L.	North East, Pa.
De Camp, A. J.	Philadelphia
Degenhardt, F. E.	Chicago
De Land, F.	"
Douglas, F. A.	Lockport
Duncan, S. A.	Pittsburgh
Duncan, H. E.	Boston
Dumas, F. C.	New York
Davis, L. W.	Cincinnati
Duisinberre, G. B.	Pittsburgh
Edson, J. B	New York
Eustis, H. H.	Boston
Ely, W. C.	Niagara Falls
Faben, C. R.	Toledo
Field, C. J	Brooklyn
Fisher, G. H.	New York
Field, C. R.	"
Foster, A. L.	Hartford
Foote, A. R.	Cincinnati
Francisco, M. J.	Rutland, Vt.
Frick, W. E.	Trenton, N. J.
Findlay, J. H.	Ogdensburgh
Gabel, E.	Chicago
Garden, Jno. B.	Wheeling
Garratt, A. V.	New York
Godfrey, J. W.	"
Goodyear, M. W.	"
Gray, R. J.	"
Gray, Wilfred	Niagara Falls
Gardner, R. M.	Hamilton, Ont.
Green, W. J.	Cedar Rapids, Ia.
Griffith, C. B.	Rochester
Glasier, H. A.	Chicago
Halm, W. G.	"
Hayes, Webb C.	Cleveland
Haskins, C. C.	Chicago
Heinrich, R. O.	Philadelphia
Henthorn, J. T.	Providence
Hill, H. W.	Cleveland
Hitchcock, C. A.	North East, Pa.
Huntley, C. R.	Buffalo
Haeberle, G.	Suspension Bridge, N. Y.
Hyman, D.	Harrisburg
Humphrey, H. H.	Buffalo
Hoeveler, J. A. E.	Pittsburgh
Hover, P. H	New York
Haley, C. S.	Boston
Jensen, J. L.	Brooklyn
Johnson, C. F.	New York
Kelly, J. F.	"
Kempt, Alex.	Chicago
Kerr, W. C.	New York
Killicutt, D.	Boston
Kinsman, F. E.	New York
Kreidler, W. A.	Chicago
Kilton, Frank	Buffalo
Lawrence, W. H.	Cleveland
Law, M. D.	Philadelphia
Leonard, S. S.	Minneapolis
Lockwood, J. E.	Detroit
Luck, L.	Antigo, Wis.
Lufkin, H. L.	New York
Lynch, E. T., Jr.	"
Lean, G. R	Boston
Latshaw, Z.	New York
Le Vake, L. B	Cleveland
Lucas, H. P.	New York
Maher, E. A.	Albany
Manson, Geo. T	New York
Marsh, J. W.	Pittsburgh
Mason, J. H.	Boston
McGrath, W. H.	New York
McQuade, G. S.	Philadelphia
McIntire, C.	Newark, N. J.
McKinlock, W. H.	Chicago
McQuaide, J. P.	New York
Metcalf, E. R.	Boston
Morrison, J. Frank	Baltimore
Morris, Rob't L.	Nashville
Morrison, W. J.	Toronto
Moses, Dr. Otto A.	New York
Mack, W. E.	Red Creek
Markland, W. H	Altoona
Merrill O. H.	New York
Martin, T. C.	"
Martin, C. C.	Parkersburg, W. Va.
Olmsted, J. A.	Rochester
Orford, J. M.	Bridgeport
Parstow, R.	Toronto
Peck, E. F.	Brooklyn
Pettingell, F. E.	Boston
Phelps, Geo. M.	New York
Pond, A. C.	Boston
Pope, H. W.	New York

Porter, Geo. F.	Philadelphia
Price, Chas. W.	New York
Possons, N. S.	Cleveland
Pfannkuche, G.	"
Penn, Jerome	Washington, O.
Pentz, J. A.	Philadelphia
Packer W. H.	Binghamton, N. Y.
Parker, R.	St. Louis
Palmer, W. C.	New York
Peabody, R. C.	Brooklyn
Pritchard, F. E.	Cedar Falls
Parker, W. H.	Binghamton
Ransom, C. M.	Boston
Ranck, D. A.	Fremont
Reid, J. H.	Chicago
Redman, Geo. A.	Rochester
Reed, H. A.	New York
Ressequie, D. M.	Brooklyn
Rhodes, B.	Niagara Falls, N. Y.
Ridlon, Frank	Boston
Richmond, C.	Fremont
Roberts, E. P.	Cleveland
Rosenstamm, S.	New York
Ross, R. F.	Boston
Russell, D. R.	St. Louis
Rudd, C. H.	Chicago
Ryan, J. T.	Philadelphia
Rushmoore, S. L.	Brooklyn
Rusling, C. S.	Kansas City
Rickle, F. S.	Buffalo
Rankin, G. L.	New York
Richards, C. R.	Brooklyn
Sayers, W. P.	Boston
Schieren, C. A., Jr	New York
Schmidt, E. D.	Cuyahoga Falls
scovill, T. L.	New York
Seymour, A. P.	Syracuse
Seymour, J. H.	New York
Shay, J. H.	Chicago
Smith, T. C.	Philadelphia
Smith, G. M.	Chicago
Small, H. H.	"
Smith, C. D.	Worcester
Smith, C. D.	Cleveland
Spencer, A. A.	Niagara Falls
Stump, C. E.	New York
Sayles, W. P.	"
Scoville, J. S.	Cleveland
Seymour, J. A.	Auburn, N. Y.
Stern, P. K.	New York
Small, H. H.	Chicago
Smead, S. F.	Cleveland
Swetland, H. M.	New York
Taltavall, J. B.	"
Taylor, Chas. A.	St. Louis
Temple, W. H.	New York
Turnbull, Geo. R.	Brooklyn
Tesla, Nikola	Pittsburgh
Tremain, H. A.	Cleveland
Temple, J. C.	Dayton, Ohio
Thornberry, H. S	Toronto
Vincent, C. R.	New York
Waterhouse, F. G.	Pittsburgh
Weeks, E. R.	Kansas City
Western, B. R.	New York
Webb, H. E.	Pittsburgh
Weber, C.	Buffalo
Wetzler, Jos.	New York
White, E. F	Brooklyn
Whipple, Fred. H.	Detroit
Wilson, W. T	Buffalo
Wilmerding, C. H.	Chicago
Williams, E. B.	Boston
Wonham, W. C.	New York
Wright, J. J.	Toronto
Wright, Alex. P.	Boston
Wyman, F. A.	"
Weber, A. J.	Buffalo
Williamson, J. H.	New York
Wilkins, F. W.	"
Wisner, A. P.	"
Wright, C. F.	Cleveland
Young, C. G.	New York
Young, S. Marsh.	"

The Electrical Clam-Bake.

The eleventh annual reunion of Electrical Clam-eaters was held at Providence, R. I., on Saturday, the 10th inst., when a large gathering of members of the fraternity enjoyed the hospitality of the American Electrical Works. President Phillips, with the efficient co-operation of Messrs. Sawyer and Hathaway, had everything arranged in the most perfect order for the comfort and enjoyment of their guests, every one of whom was made to feel as welcome and as much at home as though the entire establishment of the Vue de L'Eau Club belonged to him. Early in the day delegations arrived from Boston, New York and the country roundabout, and many of them accepted invitations to visit the Providence Telephone Exchange and the office of the Rhode Island Electrical Accumulator Company before taking the boat for the Club, which left at 11 o'clock. A bountiful lunch was served at 11.30, after which the boys indulged their varied inclinations in target shooting, kicking foot ball, etc. Two base ball clubs were promptly organized, one called the New York Club and the other the Boston Club, although the membership represented nearly every part of the country, and the game that followed would have astonished the best players in the League. Noonan, of Paterson, and Dunn, of Boston, acted as joint umpires. One of the umpires insisted on conducting the game according to the Marquis of Queensbury rules, while the other applied the regulations of the free-will Baptist Church, and they managed the game with great harmony. It was said they occasionally relieved the catchers when the latter went after lobster salad and doughnuts. Darling and Burleigh did excellent pitching, while the batting of some of the players would have been creditable to professionals. One of the left fielders insisted on having a cracker box which answered as a seat the most of the time and in which he caught the ball when it came his way. Occasionally the ball would be brought in in a wheel barrow after it had been knocked out in the woods. The game closed with a score of 11 for New York and 10 for Boston. A general frolic lasted until 3 o'clock, when dinner was announced. Three long tables, filled with guests, were presided over by Col. C. M. Ransom, Gen. H. C. Davis and Frank Ridlon respectively. Col. Ransom, as master of ceremonies, occupied the head of the center table, with Mr. Phillips, Prof. Anthony, Gen. E. S. Greeley and Henry B. Cram on his right, and Gen. Williams, postmaster of Providence, Gen. C. H. Barney and Mr. C. E. Stump, of the *Electrical World*, on his left. The following are the names of the persons present:

Prof. W. A. Anthony, Manchester, Conn.; E. F. Peck, Brooklyn, N. Y.; C. E. Stump, New York; Henry B. Cram, Boston; E. M. Carhart, Providence; H. A. Cleverly, Philadelphia; James Kempster, New York; E. B. Baker, New Haven; Geo. C. Maynard, Washington; J. F. Hedge, Jr., Providence; H. H. Wells, Providence; E. A. Smith, New Haven; E. N. Clarke, New Haven; N. C. Galvin, New York; J. F. Noonan, Paterson, N. J.; W. Peters, New York; R. H. Cunningham, Paterson, N. J.; F. J. Boynton, Boston; Norman McCarty, New York; C. A. Perkins, Boston; Geo. W. Wells, Southbridge, Mass.; John Wildman, Langhorne, Pa.; N.W. Lillie, Boston; E. C. Perkins, Providence; C. W. Holtzer, Boston; D. A. Harrington, Boston; A. L. Russell, Boston; A. H. Morse, Franklin, Mass.; M. W. Turner, Boston; Geo. W. Phillips, Norwich, Conn.; V. A. Thomas, Providence; C. L. F. West, Norwich, Conn.; D. W. Dunn, Boston; A. P. Crowley, Providence; J. H. Carghall, Langhorne, Pa.; Edmund S. Willard, Boston; A. M. Wildman, Langhorne, Pa.; F. H. Baldwin, Boston; C. W. Baker, Warwick, R. I.; Geo. L. Best, Hartford; J. J. Gates, Hartford; R. G. Perkins, Hartford; W. G. Halm, Chicago; W. A. Hathaway, Providence; Abner Coleman, Taunton; Charles sylvester, Fall River; R. S. Tabers, New Bedford; W. R. Sherman, New Bedford; A. F. Stanley, New York; John O. Darling, Providence; W. K. Magner, New Bedford; H. M. Williams, New York; F. H Hayward, New York; P. C. Ackerman, New York; W. H. Sawyer, Providence; H. Howard Sherman, Providence; D. Killicutt, Boston; W. H. Morrill, Jr., Boston; Chas. B. Burleigh, Boston; W. E. Hooton, Boston; Wm. C. Woodward, Boston; W. E. Stow, Boston; W. S. Key, Boston; Charles Brogher, Boston; S. J. Hallen, Grand Rapids, Mich.; P. H. H. Wood, Millbury, Mass.; H. E. Duncan, Boston; Frank Ridlon, Boston; C. M. Ransom, Boston; E. W. Godfrey, Boston; J. A. Sturtevant, Philadelphia; C. E. Bibber, Boston; S. R. Payson, Providence; D. A. Andrews, Boston; Levi Cofren, Boston; Gen. C. H. Barney, New York; R. F. Ross, Boston; Dr. A. de Bausset, Chicago (the air ship inventor); H. W. Daggett, Jr., Attleboro, Mass.; E. W. Fyler, Providence; Chas. Carey, Philadelphia; G. W. Adams, Boston; Frank Fuller, Boston; Geo. H. Darling, Providence; Wm. Brophy, Boston; W. H. Vielle, Boston; Suel Smith, Boston; B. F. Hamilton, New York; John I. Drake, Providence; F. C. Holst, Providence; C. R. Remington, Jr., Providence; N. B. Denison, Pawtucket; Geo. C. Gammon, Pawtucket; H. H. Fairbanks, Worcester; W. W. Dempster, Providence; Geo. W. Millard, Boston; Geo. H. Thurston, Providence; Gay A. Steere, Providence; Chas. H. Williams, Providence; J. D. Hall, Boston; A. T. Gifford, Hopedale, Mass.; Robt. Stewart, Jersey City; H. Stewart, Jersey City; John Carroll, Newport; W. D. Mason, Providence; A. C. White, Providence; C. D. Howard, Providence; J.H. Clarke, Boston; C. G.A. Peterson, Providence; A. C. Shaw, Boston; H. J. Pettengill, Boston; W. J. Thurston, Providence; W. W. Munro, Providence; H. C. Bradford, Providence; Albert Howard, Boston; R. B. Carr, Boston; Wm. E. Esten, Pawtucket; W. B. Pettengill, Boston; C. E. Lincoln, Boston; C. O. Baker, Jr., Newark, N. J.; E. A. Colby, Newark, N. J.; Gen. Henry C. Davis, N. Y.; Chas. H. Davis, N. Y.; Gardiner C. Sims, of Armington & Sims, Prov.; Geo. Worthington, N. Y.; J. Y. Bradbury, Lowell; Wm. P. Gannett, Jr., Prov.; Gen. E. S. Greeley, N. Y.; G. M. Greene, Milford, Mass.; J. W. Larish, Boston; W. L. Barnes, Boston; P. J. Hurlburt, Prov.; Gardner T. Swarts, Prov.; L. W. Clarke, Prov.; Alex. McLellan, Prov.; F. H. Raymond, Cambridge, Mass.; H. A. Breckenridge, Prov.; H. W. Breckenridge, Prov.; Preston C. Nason, Boston.

Neat, tasteful cards on which the bill of fare was printed, were attached to dinner horns with which each person was expected to announce his readiness to commence the repast, and for a few minutes "there was music in the air." What the invitations modestly called a "clam dinner" turned out to be a regular banquet, as indicated by the following bill of fare:

DINNER.

SOUP.
Clam Chowder.

FISH.
Salmon and Peas. Baked Blue Fish.
Clam Fritters.
Frogs Legs Breaded.
Fried Eels from Bullock's Point.

CLAM BAKE.
Clams. Quahaugs.
Sweet Potatoes. Green Corn. Oysters. Lobster.

RELISHES.
Sliced Cucumbers. Sliced Tomatoes.
Lyonaise Potatoes. Saratoga Chips.

BREAD.
Pontin Rolls. Brown Bread.

DESSERT.
Indian Pudding and Cream.
Watermelon. Black Coffee.

Mr. Phillips cordially welcomed his friends in a brief, appropriate speech, which was supplemented by Postmaster Williams, who represented Mayor Barker, of Providence, the latter having been unexpectedly detained.

During the course of the dinner, which was of a delightfully informal character, pointed, pithy speeches were made by Professor Anthony, H. E. Duncan, of the Waltham Watch Company, Frank Ridlon, Gen. C. H. Barney, Mr. Stump, Gen. E. S. Greeley, Henry B. Cram, Col. Henry C. Davis, and others.

Letters and telegrams expressing much regret on account of inability to be present were received from Geo. A. Hamilton, Dr. Otto A. Moses, Henry W. Pope, E. J. Hall, Jr., Geo. B. Scott, P. H. Alexander, Robert Brown, H. H. Ward, of New York; W. D. Sargent, Brooklyn; Morris F. Tyler, New Haven; Wm. Sturgis, Cheyenne, Wyoming; H. N. Gifford, Louisville, Ky.; B. E. Sunny, Chicago; Major O. E. Michaelis, Augusta, Me.; A. L. Noble, Ann Arbor, Mich.; Geo. F. West, Portland, Me.; A. W. Prout, Sandusky, O.; Frederick Bartalette, Mauch Chunk, Pa.; F. W. Webster, Lynn, Mass.; Hon. J. R. Thibaudeau, of Montreal, and many others.

At 6 o'clock the party returned to the city, everybody declaring they had never had so enjoyable a time, and vowing they would never miss one of Eugene Phillips' Rhode Island clambakes.

When the American Electrical Works invites its friends to a clam bake, Phillips and the clams always keep the appointment.

Col. H. C. Davis, of New York, is enthusiastically booming the World's Fair of 1892, and says it will far exceed any fair heretofore held, especially in electrical departments.

The Colonel landed his party at the grounds of the Vue de L'Eau Club at 1.30 P.M., having brought them up the river and through Mt. Hope Bay on a steamer furnished for the occasion by his friend, Capt. Dyer, of Fall River.

E. T. Gilliland and Lieut. Toppan are still in Europe and telegraphed regrets.

Eleven years ago a few telegraph men happened to meet in Providence and wishing to indulge in a Rhode Island clam bake, Mr. Phillips proposed to show them how to gratify their desires. That was the origin of the annual clam reunion.

A Kodak operator was actively taking photographs all the afternoon. If his views don't discount Maybridge it will be a wonder.

NEWSPAPER MEN AT THE CLAM BAKE.

Geo. Worthington, Geo. C. Maynard, ELECTRICAL REVIEW; C. E. Stump, A. C. Shaw, *Electrical World;* Col. C. M. Ransom, R. F. Ross, W. S. Key, *Modern Light and Heat;* Chas. E. Lincoln, Boston *Herald;* Isaac Kirby, Boston *Globe;* Martin C. Day, Providence *Journal.*

The World's Fair Representatives of the Electric Club.

A special meeting of the Electric Club was held last Friday afternoon for the purpose of electing delegates to represent that organization on the Committees of the World's Fair, which Mayor Grant has been empowered to appoint. The meeting was called to order by Vice-President Henry C. Davis, in the absence of President Gilliland in Europe, and, after reading the call of the meeting which had been signed by over 30 members, a discussion was entered into as to how many representatives the Club should send. The vote was a tie as to whether the Club should send one or two representatives. The Chair cast a deciding vote in favor of two delegates. Five gentlemen were then placed in nomination in the following order: Dr. Otto A. Moses, Mr. Theo. N. Vail, Gen. E. S. Greeley, Gen. O. E. Madden and Mr. Henry C. Davis. Messrs. Geo. M. Phelps and J. W. Godfrey were appointed tellers, and the ballot resulted in the election of Mr. Theo. N. Vail and Mr. Henry C. Davis. The other gentlemen all received a number of votes, and, indeed, as stated by the gentlemen voting, all the names proposed were of such able and representative character that it was difficult to choose between them. A statement of the Club's action was forwarded to the mayor the same day.

CONVENTION COMMENT.

IT WAS REMARKED DURING AND AFTER THE NIAGARA FALLS ELECTRIC LIGHT CONVENTION,

That the absence of Stanley, Baker, Royce and Patterson left a vacuum hard to fill.

That Geo. F. Porter seemed lonesome without a special train load of delegates to look after.

That the Falls were greatly admired.

That it would have been more satisfactory if the associate members had been privileged to discuss the method of their agreed burial and to say a few appropriate words as part of the obsequies.

That, as Kansas City is to be the next place of meeting, the great West will have a fine opportunity to show of what electrical strength she is composed.

That Executive Chairman Rhodes deserves much praise for his management of Association affairs.

That no Niagara Falls hotel man will ever attempt to overcharge Geo. F. Porter again —not if he knows him.

That Chicago made a gallant fight for the World's Fair, under the leadership of the versatile Degenhardt, aided by old warhorse John P. Barrett at the Chicago end, but the first claim of New York was very properly recognized.

That the members of the Association are wondering what scared the leaders of the present administration so badly that they were afraid to have anything discussed or a fair vote taken during the last session.

That Cushing could have secured several new ideas for his "Manual" had he been present.

That every one greatly enjoyed the ride down the Niagara river Tuesday night.

That the social side was well represented in the number of ladies present, and the ball Wednesday night a very successful one.

That the attendance was very good indeed for a mid-summer meeting.

That several of the attendants availed themselves of the unusual bathing facilities afforded by the great Falls, and fortunately all returned in safety from a visit beneath this vast body of falling water.

That the exhibition rooms were very convenient and were well occupied.

That the Brush and Excelsior exhibits attracted chief attention.

That Niagara Falls citizens live to make money off of visitors.

That a little less music and more prompt hotel service would have suited the guests of the International better.

That Mr. R. L. Morris, of Nashville, was the only representative from 'way down South.

That Western representatives were very scarce.

That the question of whether the meeting was adjourned for good was a much mooted one, and the President is quoted as saying the Convention would meet again at 2.30, but it didn't.

That the President has made a good selection in appointing Mr. A. J. De Camp Chairman of the Finance Committee for the ensuing six months.

That Chairman Rhodes developed a sudden wit when he informed the western delegate, who desired to know if Chicago or New York time prevailed, that the limits of Chicago did not quite extend to Niagara Falls.

That all things considered Dr. Fell can congratulate himself that he got off as well as he did.

That the Electric Light Association does not believe in "rings."

That the central station men were more pronounced in their denunciation of the last day's proceedings than were even the associate members.

That there were a number of gentlemen who would have joined the Association at Niagara had provision been made for half-yearly membership.

That the papers of Mr. Henthorn and Mr. Law were particularly interesting to the practical men of the Association.

That Mr. A. R. Foote is doing some very valuable work for the electric lighting industry.

Telephonic News

⁂ A movement is on foot to connect Watertown, N. Y., and Syracuse by telephone.

⁂ Baltimore, Md., will be connected with the larger northern cities of the long distance system in the autumn.

⁂ By the recent fire at Spokane Falls, W. T., the American Telegraph Company suffered a loss of $4,000, partially insured.

⁂ The Postal Telegraph Company has secured the right of way along the American Midland Railroad for the purpose of extending the line from Fostoria, O., to Findlay.

⁂ A. R. Prescott, the electrician at Newbury, has taken the contract to protect the Battle Monument at Bennington, Vt., from lightning. The monument is 301 feet high.

⁂ The change of the name of the Keelyn Electric Company to that of the Fritch Electric Company, has been announced at the office of the register of deeds, at Milwaukee, Wis.

⁂ The Bell Telephone Company, of Missouri, is to erect a new building, on the southeast corner of Tenth and Olive streets, to cost $126,000. The building will be 50 by 120 feet and fire proof.

⁂ The French government has notified every telephone company in that country that the government will take possession of the lines within 12 months. The service will then be furnished the public at cost.

⁂ Moncton, N. B., will probably have telephone connection with Fredericton in five or six weeks. Work is being actively pushed on the line between here and St. John, and wires are being strung on the line between Fredericton and St. John.

⁂ City Electrician French, of Cincinnati, has prepared a set of rules and regulations governing the use of all electrical apparatus for distribution among employés. R. S. Finch, a student at the university, has been appointed assistant electrician.

⁂ Thomas Harrigan is erecting a private telephone line from the State almshouse, Lowell, Mass., to the building of the Oblate Fathers, in Tewksbury, thus giving an opportunity to summon a Catholic priest in case of dangerous illness to inmates who are of that religious belief.

⁂ Thirty-five telegraph operators from Chicago went to Milwaukee last week as the guests of the Milwaukee operators. Nine of the Chicago men played ball at the Milwaukees' park with nine of the Milwaukee men, the Milwaukees winning—17 to 12. After the game the visitors were dined at Schlitz Park, and returned home in the evening.

⁂ The American Telephone Company's linemen are running the last of a line of 21 wires, connecting New York with Boston. The 21 are through from New York to the station in Shelton, and 11 run through to Boston. The last 10 are being built now from Boston, and have reached as far as Main street, Birmingham. The linemen say that the entire system of 21 wires will be completed in a few days.

⁂ Sixteen wires were burned off in the lightning arrester in the rear of the big switch in the Western Union office at Taunton, Mass., a few days ago, during the thunder storm. The lightning came in on the wires incessantly and flashed and snapped; on the back of the switch for some time there being an almost continuous sheet of flame playing around the brass work. With good ground connection, however, the danger is reduced to a minimum.

⁂ The New York Board of Electrical Control has decided to use the subways in lower Broadway, and all the companies having poles and wires in Broadway have been notified to place their conductors in the subways. It has been decided that Mayor Grant shall issue an order to the Department of Public Works requiring it to proceed to remove all poles and wires of telegraph and telephone companies in Broadway from Battery place to Park place. The electric light wires and poles supporting them will not be disturbed, no subways for electric light cables having yet been provided for this district.

⁂ Mr. J. E. Torbert has been made manager of the Charleston (S. C.) Telephone Exchange. About a year ago Mr. John D. Easterlin, the superintendent of the district, assumed the duties of the position in addition to his regular work, with Mr. Torbert as his assistant. During the past year Mr. Torbert has done much to improve the efficiency of the exchange, especially with regard to the night service, and the business is now said to be in a better condition than ever before. Mr. Easterlin will continue to exercise supervision over the Charleston Exchange as superintendent of the district, and will still have his headquarters in Charleston.

⁂ Subscriptions by Waynesboro and Augusta business men for the telephone line between Augusta and Waynesboro, Ga., have been made in sufficient amount to secure the line. The subscribers agree to deposit the amounts subscribed in the Georgia Railroad bank as soon as notified of the acceptance of the list by the telephone company. The telephone company agrees to issue coupons to each subscriber for the amount of his subscription and 20 per cent. additional. For instance, one who subscribed $10 would receive $12 in coupons. These coupons the telephone company agrees to receive in payment for use of the telephone line at the rate of 30 cents for each conversation not exceeding five minutes. They are good for two years, but may be redeemed at any time at their face value by the telephone company after three months published notice.

⁂ The interest taken in the electrical exhibition at St. John, N. B., continued to the close.

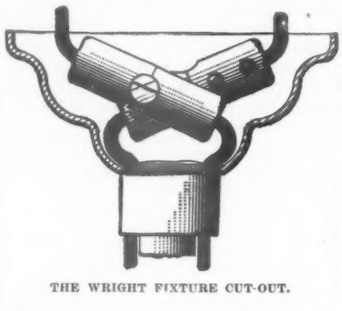
⁂ The New Brunswick Telephone Company have telephonic communication between St. John and Oromocto during the daytime.

⁂ A telegraph line has just been opened connecting Ste. Genevieve, Mo., with the outside world. The line is the property of Mr. R. B. Brown, and the citizens of the oldest town in the State are much pleased at its establishment.

⁂ The July list of subscribers of the Sunset Telephone and Telegraph Company of California, of which Mr. John I. Sabin is president and general manager, shows a gratifying increase of subscribers and extension of territory under its able and progressive management.

The Wright Patent Fixture Cut-Out.

The Empire City Electric Company has just bought out an entirely new and novel fixture cut-out, which, as may be seen in the illustration, is extremely compact and easily adjusted to any electrolier or gas fixture. It is called the "Wright Patent Fixture Cut-Out," and is said to be one of the most reliable and cheapest yet made. The size is only 1½ inches long by ⅜ of an inch in diameter.



THE WRIGHT FIXTURE CUT-OUT.

Athletics by Electric Light.

The business men who are members of the New Jersey Athletic Club, and whose only opportunities to make a pleasurable use of the club grounds are after the close of business hours in the city, have succeeded in getting the governing committee to arrange for lighting up the grounds with electric lamps. The work will be started at once and rapidly pushed to completion.

Scenery Under Electric Rays.

A novel use is made of the electric light on the St. Lawrence river, near the Thousand Island resorts. One of the lights has been placed at the end of a yard arm on the steamer "St. Lawrence," which has a dynamo aboard. The light stands in front of a powerful reflector, and as the boat steams about at night among the islands the search light is cast upon them, revealing with startling distinctness their beauty and the beauty of the landscape.

THE ILLUMINATED SIGN OF THE CHICAGO ELECTRIC CLUB

⁂ "Rialto," in the Boston *Advertiser*, reports that Messrs. Hudson and Sherman have been elected directors of the Northwestern Telephone Company, and will be elected directors of the Cleveland and Southwestern Companies, all owned by Erie Telephone Company, to represent the stock to be owned by the Bell Company.

⁂ The statement of the Erie Telephone Company for the first quarter of its current fiscal year is as follows:

QUARTER ENDED JUNE 30.	1889.	1888.		
Gross	$177,088	$163,662	Inc.	$13,426
Expenses	109,676	204,569	Inc.	5,407
Net	$67,112	$59,093	Inc.	$8,019
Construction	8,696	9,870	Dec.	1,174
Balance	$58,416	$49,223	Inc.	$9,193
*Dividends	48,000	36,000	Inc.	12,000
Surplus	$10,416	$13,223	Dec.	$2,807

*One per cent. this year, ¾ of one per cent. last year.

A Novel Sign.

The Edison Lamp Company, of Harrison, N. J., have donated to the Chicago Electric Club a beautiful and novel sign for the doorway leading to the new club rooms, 103 Adams street. The accompanying illustration gives an excellent idea of the appearance of the sign, which, it is needless to say, will be one of the features of the club rooms.

The sign was made at the Edison Lamp Company's factory, and consists of a large board, covered with black velvet, mounted upon which are 208 small three candle power incandescent lamps forming the letters of "Chicago Electric Club." The lamps are socketed and fit into receptacles which are screwed upon the face of the velvet covered board. The whole front is covered with plate glass, the electrical connections being made at the back. The lamps are arranged in groups of 13 in multiple arc and 16 of these groups in series, and will be run off one of the Edison city circuits. The finish is very fine, and when it is remembered that the dimensions of the sign are five feet long by two feet wide, it is seen that the Chicago Club has a "door plate" of which it, as well as the manufacturers, may well be proud.

Appreciation of Improvements.

The Nashville *American* thus soliloquizes on recent improvements made there:

The citizens of Nashville have always been noted for their modesty and conservatism, and these characteristics have, to some extent, kept the outside world in ignorance of the genuine progress that is going on in this city.

In the matter of street railway facilities Nashville is unexcelled, and improvements are being made constantly that will keep it in the van in this respect, yet few people outside the city know it, and there are many, doubtless, inside who have never given the matter a thought.

A little over a year ago the city had excellent street car systems of the old mule variety, it is true; but within that short space the dummy motor has made its appearance on three lines, and electric cars have made their advent on a third; and now it will be but a short time before all cars operating exclusively on city lines will be propelled by electricity.

Addition to the Phonograph.

At a recent meeting of the French Academy M. Lippmann presented a note by M. G. Gueroult, in which it is suggested that by the combined use of a phonograph and an apparatus for instantaneous photography and reproduction of the pictures obtained it would be possible to reproduce at any future time not only the speech of a person, but also bring before the audience a vivid picture of the person's gestures and facial expression.

The procedure would be somewhat as follows: A person speaking or singing into the phonograph would be photographed by an automatic apparatus geared with the barrel of the phonograph. The pictures would be instantaneous, and taken at the rate of, say, ten pictures per second. They would then be developed and arranged in a special lantern for reproduction on a screen isochronously with the phonograph, when the latter is reproducing the speech. An audience might thus be enabled not only to hear the utterances of, say, a famous actor, but also see himself and his actions represented on a screen. About a year and a half ago M. A. Bandsept, of Brussels, experimented with a similar apparatus.

⁂ Sixty of the 100 telephone wires in Norwich, Ct., were rendered useless, and 18 annunciators in the general office were burned out Saturday by lightning.

⁂ The Erie Company make a net gain of 240 new subscribers in the quarter against 204 in the same quarter last year. The total connected July 1, 1889, was 11,564 against 10,747 July 1, 1888, and 9,998 July 1, 1887.

AT NIAGARA FALLS.

(*Continued from page 3.*)

simply of New York and Chicago, because those are the only invitations we have to consider to-day.

The President: I demur to what the gentleman says in regard to the Fair being held in Chicago. I think that on account of its central geographical location, and the great number of railroads there centering, Kansas City should be the point. (Laughter.) But, gentlemen, that is not the question. The mayor of Kansas City is not on the records of the Association with an invitation to the Association to co-operate with him, neither has the mayor of Chicago sent such an invitation. We received a telegram from a gentleman connected with the mayor in an official capacity in Chicago at the eleventh hour. I think the communication from the mayor of New York has been received several weeks, and has been replied to by the President of this Association on general principles, assuring him that he might have the co-operation of the interests represented in this Association, looking to the holding of a World's Fair, not especially in New York, but anywhere. Now, it seems to me, gentlemen, that the action proposed by our Committee does not commit the Association to any locality, but is purely general and is eminently in order.

Mr. Geo. M. Phelps, of New York: Mr. Chairman, I do not think that any of the gentlemen who have spoken, if about to answer an invitation to dinner, and he were told that somebody else was about to send him a letter of invitation to another dinner the next morning, I do not think he would pass the question on that account, and my opinion is that we are invited simply to co-operate in organizing a World's Fair in New York. Now, we hear that Chicago has some notion of having a World's Fair too—we have one invitation before us, and are told that we may get another. When that comes we can answer that.

Mr. Alex. Kempt, of Chicago, Ill.: Mr. Chairman, I understand the position to be this: The gentlemen of Chicago do not desire that this Convention in any shape or manner, shall delegate to New York any preference in the question of the location of the World's Fair. That the electrical fraternity should be represented at the New York effort is proper and fitting, but that this Convention should not indicate its preference for New York, Chicago or any other city. I think if that is the animus of the resolution, it is right—that this Convention do not make a selection.

Mr. Charles A. Brown, of Chicago, Ill.: I coincide heartily with what Mr. Kempt has said, and with what Mr. Kriedler said before, and I further agree with Mr. Kriedler that the resolution read by Chairman Rhodes does not thoroughly express the idea it intends. Mayor Grant has sent an invitation, taking it for granted, just as Mayor Cregier, of Chicago, would take it for granted, that the World's Fair is to be held in Chicago. Steps have been taken and money subscribed, just as in New York. Now, an invitation from Mayor Grant, based upon that assumption, if responded to in the way suggested by Mr. Rhodes, does commit the Association to the World's Fair in New York. I cannot see any way out of it. We may say that it does not, but the effect of such action is to actually commit us. I therefore offer in substitution for that resolution the following:

WHEREAS, The location of the World's Fair has not yet been determined upon; and

WHEREAS, The National Electric Light Association will have several meetings between the present time and the time designated for the said World's Fair,

RESOLVED, That it is the sense of this body that a vote of thanks be tendered Mayors Grant and Cregier for their recognition of this Association; and that the president of this Association in formally expressing to Mayors Grant and Cregier our appreciation of their courtesy, should state that a committee will be appointed at the proper time to represent the electrical interests in the World's Fair, wherever it is to be held, without expressing at present any preference as to the location.

Mr. P. H. Alexander: Mr. President, I think that this last resolution should come up some time, but not at present. The Mayor of New York City advises this Association that a World's Fair is to be held in New York City, in 1892; not *the* World's Fair, but *a* World's Fair. We just learned that Chicago intends to hold one in the same year. But we are dealing now with an invitation of Mayor Grant, of New York City. He has not done as the mayor of Chicago has done, selected his committee, but he has sent around to the different organizations representing trades and businesses of all kinds, and asked them each to appoint one man, who shall be the representative on the committee of one hundred that he is forming, irrespective of any other city. He does not seem to have any jealousy whatever. He merely asks all the trades to come in and help him in the organization, by appointing a man of their own kind. He honored this Association by such an invitation; he thought they were broad-minded men—men of national ideas—not in favor of New York, or of Chicago, or of Kansas City—he merely asked the Association to appoint a man upon that committee. If this man is to be appointed, his name must be sent in before next Friday. Consequently any other answer we may give, except the appointment of the man, would be an evasive answer or a discourtesy to a man who, out of 100 men, only asked this Association to appoint one. I think it is a great honor conferred upon this Association.

Mr. Kreidler: I want to second Mr. Brown's motion. It seems to me that Mr. Alexander is playing upon words. We all know that New York is not going to hold *a* World's Fair, neither is Chicago. If the World's Fair is held in New York, it will not be held in Chicago, and if it is held in Chicago, it will not be held in New York. If it is to be in New York, nobody will be more willing than the Chicago members to make it a success. But we do not want to commit the Association to anything just now, and that is why this substitute of Mr. Brown's has been offered and I want to second it.

Mr. Degenhardt: Mr. President, in rising to second Mr. Brown's resolution, I wish to put myself right before the Convention. I am under the impression that they thought I was not willing to thank a man for his courtesy. I believe Mr. Brown's resolution covers the question. If the word Chicago is to act as a red flag, strike the word out. There should be no expression in favor of any city. My judgment is that we have as good right to demand for the city of Chicago the recognition that Mr. Weeks has asked for Kansas City. I don't know that in speaking of the broad gauge of the gentlemen here, that it savors of narrow gauge when we shout for our own territory. The allotment of this committee by Mayor Cregier was done with a view of ascertaining what co-operation can be had throughout the United States to bring this World's Fair to Chicago. The same thing appears to have been done by Mayor Grant, of New York. The position is identical.

Mr. De Camp: Do I understand that we have a communication from the mayor of Chicago?

Mr. Degenhardt: I understand there has been an official communication from J. P. Barrett, who acts for Mayor Cregier.

Mr. Phelps: Would it not be time enough to answer the mayor of Chicago when you hear from him?

Mr. De Camp: This courteous letter from the mayor of New York is a compliment to this Association, and one which demands a prompt and positive reply. I do not see that this Association commits itself in a single degree by responding to that favorably, and reporting that committee at once. If Mayor Grant fails to have the Exposition held in New York, then the whole thing falls, and some other city will take it up; but as the matter stands to-day, New York is unquestionably ahead in that matter. (Applause.) Now, it is three years ahead, but three years is a very short time to provide for an exposition of that kind; it ought to have been five. Now it is a fact that the mayor of New York is ahead, and if anybody comes in later, they are going to suffer from want of time. We have either got to reply to that or not to reply to it, but if we reply to it at all, I think we should make a positive reply, because Mayor Grant means business. He wants somebody to represent this interest, and if the gentlemen connected with it cannot represent it, the interest will probably go without representation. I think we have everything to gain and nothing to lose by passing this resolution.

Mr. Brown: Mr. President, the point made by Mr Kreidler and Mr. Kempt seems to be not to have been answered. I deem it entirely possible to answer Mayor Grant and to appoint a representative to meet him, but if we do that under the language used in the resolution offered by Mr. Rhodes, we will not then be in position to make any reply to Mayor Cregier when his invitation in equally strong terms comes to us. This resolution, I think, is in the nature of a promise; that is, it does commit the Association. I think Mr. Rhodes' resolution does commit the Association, and therefore I sincerely wish that the Convention would consider carefully the language of the two resolutions before it commits itself, as I think it would by voting affirmatively on Mr. Rhodes' resolution.

Calls for the question.

Mr. Brown's amended resolution was then read, and upon being put to vote, it was declared lost. A standing vote was called, with same result.

Mr. Brown: I move you that the resolution offered by Mr. Rhodes be amended by striking out the last clause in that resolution: "In making the Exposition a success."

Mr. Alexander: Mr. President, it seems to me that we are misunderstood. The committee is called by the mayor as a committee of conference, to "aid in making it a success."

Mr. Kreidler: I made the remark that the Committee seemed to have the right idea of the matter, but have not worded it properly as we interpret it. A few words put in that resolution, or a few words taken away, as Mr. Brown suggests, would make it entirely satisfactory to everybody and still render it entirely possible to send Mayor Grant an entirely satisfactory and decent reply. It seems to me that it would be a good deal better if we would use Mayor Cregier's name in addition to that of Mayor Grant.

Mr. Morris: I am in favor of an open field and a fair fight. New York and Chicago are making a bid for this Fair. The door is left open to us. If Chicago asked for a life member from this Association, it would not be inconsistent upon our part to give them a man upon their committee also, but as the resolution is worded, it seems to me to commit this Association to New York, and to throw your influence and your vote in its favor. Now, I say, let us leave that door open, and we do leave it open when we strike out these words. That complies with Mayor Grant's request to give him a committeeman. If Chicago asks for one we will give them one.

Dr. Otto A. Moses, of New York: I think the exception taken by the gentleman from Chicago is, if we look at it from a literary point of view, quite correct. There is no necessity to add to it, "to aid in making it a success," because it would be a discourtesy to carry any double meaning. Therefore, I think and second the motion of Mr. Brown that these words be erased.

Upon motion duly seconded, the amendment proposed by Mr. Brown was carried.

Mr. H. W. Pope asked that other electrical bodies be corresponded with.

Mr. Alexander: It seems to be impossible for this Association to get a representative on that committee. The Committee has not time to correspond about it, because he must be appointed before Friday next. If it is the intention of Mr. Pope to defeat this motion, he uses the right means to do so, in proposing that they should correspond about it.

Mr. Morrison: It strikes me that the amendment is superfluous. Let us take a look at the case just as it stands. The mayor of the city of New York wrote a letter to the president of the National Electric Light Association, and asked him to meet him at a certain day to confer with him as to certain methods to be adopted in the organization of the proposed World's Fair. To this the president of the National Electric Light Association replied that it was impossible for him to meet the mayor of New York, but that the National Electric Light Association, he felt sure, would aid in every way to make an affair of that kind a success. To day you have to deal simply with the mayor of New York; you have to deal simply with the invitation. It is a question as to whether you accept it or reject it. He is the chief magistrate of the metropolis of this country, the commercial metropolis of this country. If he were the chief magistrate of any other city, the same courtesy would be due from this Association as is to-day due to the chief magistrate of New York City. If the mayor of Chicago had sent to this Association or to its president a communication of exactly the same character, I would be on my feet advocating for the mayor of Chicago exactly the same courtesy and polite treatment that I now ask of you for the mayor of New York. As to the amendment, I beg to say that the National Electric Light Association has to day, and will have for some time to come, all it can attend to to mind its own business. It is not here for the purpose of choosing representatives or making channels through which representatives of other like bodies in this country can come. It is not here to deal with the Telephone Association, or the Engineers' Association, or any other association except the National Electric Light Association; so that upon that ground I should deplore tacking on an amendment of that character, which can do no possible good, and may do some harm.

You have lots of business ahead of you here, and have plenty to do between the morning and evening, and you will find your hands full if you deal with these things which bear directly upon the business of the Association.

Mr. Pope: I have no desire to retard the progress of this matter. I appreciate the position. My only desire was to give everybody a chance. I withdraw the motion.

The President: The question is on the adoption of the resolution as offered by the chairman of the Executive Committee.

Upon motion duly seconded, the resolution was adopted.

The President: We will now hear the report of the Committee on the Revision of the Constitution and By-Laws, through its chairman, Dr. Otto A. Moses, of New York.

Dr. Moses: Mr. President, I have the pleasure, as chairman of the committee to report upon the revision of the constitution, to offer the following as the unanimous report of our committee. We had to arrive at the facts and the propositions made in this by means of a very extensive correspondence. We have now on file in the hands of the secretary about 125 answers from the members of this Association, to whom were referred questions which were crystallized in this report. From a majority—from a very large majority—of the answers, it became possible for us to offer this, as I might call it, almost unanimous opinion of the members of the National Electric Light Association. For the convenience of the members, this report has been printed in such a way as to be opposite to the old constitution—the present constitution—that is on the left hand column; on the right hand column is the proposed constitution.

(Dr. Moses then read the printed constitution.)

Mr. Alexander: As no amendment can be voted upon on the day of its first presentation, I move you, sir, that printed copies of this proposed constitution be distributed among the members, and that this business be made a special business for Thursday morning at 11 o'clock.

Mr. Eugene T. Lynch, Jr., of New York: I will second the motion, but I suggest as an amendment that it be made to-morrow morning at 10 o'clock.

The President: I would say that the printed copies of this report of the committee are in the boxes that have gone astray, which we expect to receive any moment. Directly that package arrives, those

copies will be distributed to the members. Does Mr. Alexander accept the amendment?

Mr. Alexander: I should make it to-morrow afternoon.

Mr. Lynch: We have a special order of business for to-morrow afternoon—the electrical execution cases.

Mr. Alexander: We have a number of representatives of insurance interests here who are very anxious to get back to-morrow, and there are certain matters to come up to-morrow morning to be discussed before them and with them.

Mr. Lynch: I withdraw my amendment.

Mr. De Camp: Is it the first order of business on Thursday morning?

Mr. Alexander: I made it 11 o'clock.

Mr. De Camp: I do not know, but I think the last day of this Convention—this is practically a new constitution, and it comes up in the form of an amendment to the old constitution. Now, if any amendment that may be offered to this amendment comes under the restriction of the constitution, which says, that shall be laid over for a day, then what object is it to have it come up Thursday? It should come up to-morrow so we can get rid of it. Will the Chair decide that question?

The President: The Chair rules that such amendment would have to lie over.

Mr. De Camp: That is an amendment to an amendment.

The President: Yes, sir.

Mr. De Camp: Then I hope the resolution offered by Mr. Alexander will not prevail.

Mr. Alexander: Do I understand that an amendment to an amendment must lie over?

The President: I so understand it; no amendment can be voted upon on the day of its presentation.

Mr. S. A. Duncan, of Pittsburgh: Once the report is before the body and acted upon in *seriatim*, section by section, it is the property of the body. It is not then an amendment to the constitution, as provided for something which is original matter. Therefore, if the Chair will consider, he will see the position—that you can alter, change or amend any word of the subject matter properly brought before you.

Mr. De Camp: That is the view I take of it.

Mr. Brown: But, Mr. President, there might be entirely new amendments offered, and they would certainly have to be laid over under our present constitution.

Mr. De Camp: Then there is a possibility of never having an amendment pass this Convention. It is possible there may come a more striking incident than this—a case where it would have to lie over.

The President: A motion is before the Convention to make it a special order of business for 11 o'clock Thursday morning. The point was raised as to whether an amendment to an amendment could be considered without laying over, as provided by our present constitution. The Chair held that it could not be acted upon. I think, however, after hearing from Mr. Duncan and Mr. De Camp, that the Chair will have to recede from his position.

Mr. Morrison: I think so. The object in presenting this paper is in answer to the demand made for certain amendments to the old constitution. It was submitted to the last Convention and sent over to a committee composed of the representatives of the various interests represented in the Association—the electrical supply men and others, and in the committee they have formulated an amended constitution, based upon the information which they have received by mail, as I understand it, as to what would best serve the interests of a majority of the members of the Association. Now, it is to deal with that paper that we are called. If you take it up to-morrow or Thursday, or whatever day you take it up, I judge that the members of this Association will desire to dispose of it as quickly as possible. It does not go with the saying that the provisions of the constitution will be adopted. It is simply the report of the committee. The committee was created by this Convention, and its work will have to be passed upon by this Convention; but if you take up a paper with a view of disposing of it, article by article, there will be no difficulty with getting through with it in a very short time. Every one will be prepared to present his views as it comes up, but there is one point you have not considered. There is no constitution you can pass now that will be operated until after the expiration of the fiscal year.

The President: We certainly could not legislate members out of the Association.

Mr. Morrison: No, sir. The gentlemen here have paid their $20 for active membership in the Association. I have paid my rent for twelve months, and you cannot put me out until the expiration of the year, and you can pass no legislation which will take from them the right which they have paid their money for. So before you get through you will have a motion to leave that matter until the time comes when the paid term of these gentlemen has expired. These gentlemen have paid their rent for a year. I think we ought to take up and dispose, as far as possible, of each paper as it comes along. We are here for the purpose of profit. I do not see as it makes any difference whether you take this paper up to-morrow or Thursday, however.

The motion being duly seconded, was carried as amended by Mr. Alexander.

The President: We will now hear the report of the Committee on Underground Conduits and Conductors, of which Mr. Lynch is chairman.

Mr. Lynch: On behalf of the committee, I will report that the committee has decided to ask the Association for a little longer time to make a report; that it be delayed until the next annual meeting of the Association. It is a very short time, only six months, since we made our last report, which was rather long, and provoked a great deal of discussion, and we respectfully request that the time be extended until the next annual meeting.

Mr. Morrison: It is the report of the committee, and it is a question of the adoption of the report of the committee. If you adopt it you only continue the committee. I think they are getting ready to make a report down in New York. (Laughter.)

On motion duly seconded, the report was adopted and the committee continued.

The president: Owing to the fact that Mr. Alexander's manuscript is in that lost box, we will have to pass the report of that committee. We will now hear from Mr. A. F. Foote, of Cincinnati, on the "Value of Economic Data to the Electric Industry."

Mr. A. R. Foote then read the following paper:

"THE VALUE OF ECONOMIC DATA TO THE ELECTRIC INDUSTRY," BY ALLEN R. FOOTE.

1. All data have an economic basis. True progress depends upon the right use of correct data. Without such use of such data, no problem can be solved, be it industrial, political, social or religious.

2. To-day, every proposal for improving the condition of mankind, is based upon data. Read:

1. "Economic Aspect of Trusts." By George Gunton. *Political Science Quarterly*, September, 1888.

2. "Remedies of Social Evils." By Edward Atkinson. *The Forum*, April, 1889.

3. "Legislative Injustice to Railways." By Henry Clews. *North American Review*, March, 1889.

4. "Signs of Impending Revolution." By William Barry. *The Forum*, April, 1889.

5. "The Relation of Modern Municipalities to Quasi-Public Works." Publications of the American Economic Association, Vol. 2, No. 6, January, 1888.

6. "Looking Backward." By Edward Bellamy. Houghton, Mifflin & Co., Boston.

7. "Robert Elsmere." By Mrs. Humphrey Ward. George Munro, Publisher, New York.

You will find that the direction and strength of all augument is centered on the testimony of evidence obtained from the history of experience. Experience, truthfully recorded and properly understood, is the source of all value in knowledge.

3. The electric industry is based on the experience gained by the utilization of the discoveries of science which preceded it. Its development depends upon a truthful record of its own experiences, and the adaptation of the instruction derived from its own data.

4. To secure the best results for manufacturers, for those who invest in central station plants, and for the users of their services, the data of the industry must be reliable, complete and accesible. It should cover all apparatus, every operating plant, and the price paid for services rendered in every locality. If such a record can be obtained and maintained from year to year, it will be found that the science of data and the command of those agencies by which it may be obtained and utilized, is the most important factor in the development of the industry. As is the prosperity of the users of service, so will be the prosperity of the supplyers of service. As is the prosperity of the buyers of apparatus, so will be the prosperity of the manufacturers of apparatus.

5. The electric industry has been born and carried to its present state of development within one decade. This is evidence of the marvelous skill and honesty of manufacturers, operators and users. The value of this testimony is enormous. It is proof of an average intelligence, a reliability of character and workmanship, far superior to the attainments of any other generation. It furnishes a reliable foundation, on which future development can securely rest. It is the prophecy of the accomplishment of results, such as have never before blessed any age.

THE VALUE OF ELECTRICAL AND MECHANICAL DATA TO MANUFACTURERS.

6. A long list of electrical and mechanical apparatus is assembled and used as one machine, in the construction and operation of a composite central station. Every manufacturer of each part of this apparatus is vitally interested in knowing the exact truth regarding the performance of his specialty, under the widely varying conditions found in the practical operation of a large number of central stations. It is to his interest that he should claim for his specialty all the advantages it is capable of developing, and no more. The profit of a sale made on the basis of guarantees that cannot be realized, is a disastrous loss.

7. Inventors, designers and manufacturers use their best efforts to supply a piece of apparatus that shall be the best for its purpose and price. They take careful note of all obtainable experience, and then attempt to take one step in advance by making an improvement. This is the natural law of progress. Their claims for their improvements are honestly made. They are based on tests made in laboratory or shop where their apparatus is handled by experts under favoring circumstances. The value of improvement depends upon its advantages proven by the tests of practical use when operated by persons representing all degrees of skill, under the widely varying conditions found in a large number of central stations. If it is necessary to take careful note of past experiences, and to keep a careful record of the data of performance during construction, is it not much more necessary to keep a careful record of the data of performance when in practical use? With such a record for a guide, manufacturers and buyers can feel a comforting assurance of certainty in their transactions. This, however, is not the most valuable consideration. Those who accustom themselves to keeping properly systematized central station records for the purpose of testing the claims of manufacturers of electrical and mechanical apparatus will become good observers. More often than otherwise, they can suggest some simple change in the apparatus which will enable the manufacturer to fully realize his expectations.

In fact, it may often be found that the manufacturer has claimed too little, instead of too much, for his improvement. If he can secure proper data from the operators of a large number of central stations, he can remodel his claim as well as his apparatus in the light of recorded experience. This will make an enormous gain for him. It will enable him to base his business on a firm foundation not otherwise obtainable. In this there is surely sufficient reason for every manufacturer to encourage, in every way that is open to him, the keeping of systematic records by central station companies having for their object the collation from experience of electrical and mechanical data.

THE VALUE OF OPERATING, MAINTENANCE AND ADMINISTRATION DATA TO CENTRAL STATION COMPANIES.

8. Electrical and mechanical data is but one feature of the record upon which the success of central station companies depends. To complete the circuit, records must be kept of the data pertaining to all details of operation, maintenance and administration.

9. No manager can be equally competent in all departments. Unassisted he cannot observe all the details of the wonderfully complex business assembled in the operation of a composite central station. Upon the keeping of systematic records by his employés depends the ease of his position and the efficiency of his management. The value of a properly devised system of records of the daily operation of a central station can hardly be overestimated.

10. A manager may regard many items in his accounts as reasonable, representing the best that can be done, which, when compared with the accounts of some other manager, whose genius or experience has directed his attention especially to such items, will appear entirely out of the way. No better guide can be found, to where improvement is possible, than such comparisons. The value of the comparison increases in ratio to the number of accounts with which it is made. It is, therefore, to the interest of every central station company to do all in its power to induce every similar company to be represented in an organization through which the desired data can be made available to each.

11. While managers of central station companies can render service of undoubted value to manufacturers by keeping truthful records of electrical and mechanical data, manufacturers can repay managers *in kind* by suggesting improvements in their methods of operating their plants. A manager is isolated. He can observe his own work and methods only. The representatives of manufacturers are everywhere. They observe the work of all managers and are quick to detect the methods of those under whose management their particular specially produces the best results. Having found this, it is to their interest to communicate the information to every user of such apparatus. Thus, by each manufacturer looking after his own interest, each manager will receive the educational benefit of the experience of all managers pertaining to every detail of the apparatus under his control.

12. By means of the comparisons indicated, covering all electrical and mechanical data and all items of expense and income, any manager will be able to show to his directory how the results of the business he is doing for them compares with the results of all similar undertakings. It will give him the ability to indicate to them unerringly, what changes, if any, must be made in their policy or plant, to enable them to realize the best obtainable results.

13. In furnishing the evidence obtained from the history of his own experience, each manager receives in equal exchange the record of experience of all others. He must be an expert and a wise man who can claim that he will not be a large gainer by such a transaction. Rightly estimated, the gain of each company, from the judicious operation of a proper system for recording and comparing data, will be so enormous, that none, much less the smaller ones, who can least afford to employ highly developed talent, can afford to be without a membership in the organization through which it may be secured

14. No more pertinent illustration of the value of systematic and organized effort to improve a special feature of the electric industry can be required than that which is found in the work of the New England Exchange. If the well devised system that has been developed by the workers in that special field can be adopted by the National Electric Light Association as one of its features, that fact alone ought to be sufficient to secure it a membership from every central station company in this country.

THE VALUE OF DATA TO THE USERS OF ELECTRIC SERVICE.

15. The value of economic data to the electric industry cannot be completely stated without considering the interests of the users of electric service.

16. From an electrical or mechanical point of view, the value of all apparatus finds expression in light or power. From an industrial point of view its value is expressed in the advantages it brings to the users of its service. These advantages are limited by what it enables them to do and what it costs to do it.

17. The advantages of electric service are not wholly under the control of manufacturers of apparatus, nor of the owners of central stations. Their development depends largely on the public policy of the community in which the service is rendered.

If that policy places unnecessary restrictions on the business of the central station company, imposes on its method of construction, having no foundation in engineering requirements, nor in true considerations for the public safety or convenience; or, if it holds over the company an eternal menace by being willing to grant a franchise to a raiding enterprise, under the mistaken idea that prices can be permanently cheapened by competition; it will pay a righteous tax for its mistakes, in the price of the service it uses.

A comparison of the results of such a policy, with that of a community that intelligently permits construction in accordance with the best engineering requirements, and true consideration for the public safety and convenience; that sets itself as firmly against an ordinance permitting competition as it would a declaration of war, cannot fail to educate all users of service to a correct understanding of true economic conditions.

18. In the competition between cities, states and nations, the utilization of the discoveries of science in accord with the requirements of natural economic law, is a

more potent factor in securing industrial supremacy than the possession of natural advantages. The day has come when intelligence is master of physical forces. When these truths are properly understood the users of electric service will demand and enact economic legislation that will secure the interests of the manufacturers of apparatus, the supplyers and the users of electric service, on terms that will enable each to realize the highest economic advantages than can be derived from the perfect development of the electric industry. The advantages of a puplic opinion so educated should not fail to cause all who can to unite in securing the data on which it must be based.

THE VALUE OF DATA TO INVESTORS IN ELECTRIC STOCKS AND BONDS.

19. The proper construction, equipment and operation of a composite central station, designed to supply a community with the foundation necessities for industrial prosperity, and domestic comfort and refinement—*heat, power and light*—is an undertaking beyond the reach of ordinary private capital. It is a public improvement, the capital for which must be secured by the sale of the stocks and bonds of the company organized to carry on the enterprise.

20. A central station company must be organized under the state law. It must operate under a municipal franchise. From its birth, through all its existence, it must be subject to the regulation and control of state and municipal legislation. This fact should secure for its stocks and bonds a financial standing equal to that of the best securities in the world. That they are not so held is evidence that there is a lack of data regarding them, and an unwise or unsettled condition of public policy regarding the tenure of their occupation of the field of their operations.

21. In my opinion, the exercise of state authority for the regulation and control of companies organized under state laws to operate under municipal franchises, should be so used as to render their securities as safe and profitable an investment as are the securities of national banks. Both are creations of legislative enactment. Both supply fundamental wants of industrial life. A calamity that would render users of *heat, power and light* incapable of paying their bank obligations. Organized to supply necessities of civilized life, based upon the prosperity of the communities in which they are located, guaranteed by the ability of users to pay for a service that secures them an industrial advantage, there is no economic reason why the securities of central station companies should not be a favorite investment for all who desire *permanency, safety and profit.*

22. Large investors require the greatest certainty and accept the smallest return for the use of their capital. All data and all legislation that tends to secure safety and permanency of investment, will tend to make capital abundant and cheap for central station companies, and thus enable them to reduce the cost of their service to its users. A community can serve its interests in no better way than to exercise its power of regulation and control, to secure the necessary data to guide intelligently, investments in public improvements and its own legislative action.

23. The securities that to-day bring investors the smallest returns are those of the public debt. They represent the destructions of war. This fact does not prove that the destructions of war are of greater service to humanity than the constructions of peace. It proves that a nation, as well as an individual, will give all it has for the preservation of its life. That it may always command "the sinews of war," it cannot allow its credit to become impaired. For this reason, the natural law of self-preservation has quickened man's intellect to devise laws for public finance, designed to give the greatest possible security to investments in Government bonds. Next to the duty of preserving life, is the duty to make life worth living. Government will confer its greatest benefit on society when it renders investments in those enterprises which daily supply the necessities, comforts and refinements of life the best securities in the market. This done, capital, the sinews of peace as well as of war, will flow to such enterprises in abundant supply, and humanity will realize a condition of civilization such as the world has never yet enjoyed.

THE VALUE OF DATA COLLECTED BY GOVERNMENT AUTHORITY.

24. Every 10 years, under direction of the national Government, a census is taken. The history of the development of the national census among all peoples is the history of their appreciation of the value of data. From the mere enumeration of men able to bear arms, census taking has broadened until it includes all data having a social or industrial interest.

25. The census of 1880 has no section for the industry of generating and distributing from central stations electric service for the uses of light and power. The census of 1890 should have such a section. If the data for it is properly collated and arranged, it will make a marvelous exhibition of the birth and growth of an industry in the short space of one decade. The annals of civilization may be searched in vain for a parallel to it.

26. The data so acquired and published by authority of the national government, will give an impetus to all electric central station service, that will cause the record of the decade from 1890 to 1900 to be one of the transformations of methods of generating and distributing the means of supplying cities and towns with *heat, power and light.*

27. In 1900, the electric light will be the light of the present, the operating of street cars by horses will be unknown, and physical labor for man or woman in all industrial and domestic occupations will be reduced to a lower minimum than has ever yet been realized.

THE TRUE BASIS FOR THE WORK AND INFLUENCE OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

28. None of the results indicated can be obtained, desirable as they may be, unless they are the results of system and organization.

29. That records may be kept regarding pertinent points only, and with the least work or cost; that the data may be so tabulated that it can be readily understood and compared, a uniform system of records and accounts must be devised, covering all points of interest. To devise such a system, and institute proper comparisons for the use and benefit of all central station companies, is the direct and most important work of this association. By doing this, it will furnish a reason for all central station companies to be represented in its membership. Such a membership will give to its deliberations and actions an influence that will have all the binding force of law in some directions, and in other particulars it will so direct public opinion that laws will be shaped in accordance with its views.

30. It will establish the electrical and mechanical value of all apparatus. It will develop the operation of central stations into the best organized and most reliable service in the country. It will secure the highest possible degree of economy, and the most reliable returns for invested capital that can be found in any industry. In doing this, it will be a large contributor to the material prosperity of the people.

31. The work and influence of the National Electric Light Association must begin in data, they must be sustained by data, they must have for their objective point the securing of data.

32. Data are recorded truth.

33. "Commend to the keeping of the Truth whatever the Truth hath given thee, and thou shalt lose nothing."—St. Augustine.

Mr. Foote: Mr. President, to give practical effect to my paper, I respectfully submit the following for the action of the Association:

WHEREAS, It is desirable that this Association shall collect for the use and benefit of its members, complete and accurate data regarding all important details involved in installing, operating, maintaining and administering the plants and business of central station companies;

BE IT RESOLVED, That a Committee of Five be appointed by the President, to report at the next Convention of the Association, forms and a system of records and accounts to be kept by central station companies; a system for reporting the same to the Association, and for comparing and publishing the data so secured, for the use and benefit of the members of the Association.

The motion was seconded by Mr. Brown.

The President: The paper is now before the Convention for discussion.

Mr. Morrison: Mr. Foote is engaged in a work that almost every one has neglected, and yet without which work we would probably never be able to conduct the electric light business successfully. It is the true channel through which information should come. If you can once get down to the point where men will come into the National Electric Light Association, and state in plain terms their plans and their methods, and the result accomplished, then you will have gotten to the point where the original idea of the National Electric Light Association can be carried out. Mr. Foote is on that track. I believe I am doing him scant justice when I say that he has spent more time and more money in the service of the National Electric Light Association during the past 12 months, than any other man in it, from its president down to the last man on the board. (Applause.) I think that such work should be appreciated. I believe it will be appreciated, and I think in the end appreciated in a substantial manner to Mr. Foote.

I do not desire to take up any more of the time of this Convention than I can help. I made a promise to myself and some of my friends that I would not talk in this Convention. But it gives me a great deal of pleasure to second Mr. Brown's motion to adopt this resolution, and it was for that purpose I rose to my feet.

The President put the resolution and declared it carried.

Mr. Robert L. Morris, of Nashville, Tenn.: I believe this is the second meeting of this Convention that I have attended, and as a member of the Executive Committee, I can say that I am glad to come and get the new kinks and points from others, and get practical benefit from them. We have had a representative, I believe, at every meeting, and I have attended two or three of them myself. But it has been an unsatisfactory thing to me. I have come to these meetings, and my manager and my superintendent have come. We come here and go away not feeling exactly that we have got what we came for. What we wanted was new points, practical points. We have come here and heard a great many theories upon electric light matters, and all that sort of thing, but that was not what we wanted. We had a committee here at one time to consider which was the best wire. I tried at one time to get a report out of that committee, but I could not do so, and nothing practical was done. Now, Mr. Foote's paper seems to me to be striking out in the right direction—to get at the practical, to get things that will benefit local electric light men. That is what I am here for, representing that sort of an interest. While I don't believe that it is hardly practicable to get this data, such as that resolution calls for, and while I believe that very few companies are going to disclose their private business, show us exactly what they are doing, and all that sort of thing, yet perhaps they will be willing to tell us something about the operation of their machinery, how it is produced, what is the effect, and such as that. If I am asked what is the best lamp, I don't hesitate to say But I think that perhaps we can safely risk this Convention, composed of members from different electric light companies, to express itself in behalf of a measure so evidently for the benefit of us all. I do not mean to say that we are going to ascertain so many practical things, because everybody that is operating a plant, it is natural that he is going to stand up for his kind of machinery; if he is running a Thomson-Houston he is not going to say that something else is better; and we cannot hope always to get at the true inwardness of the thing; but we can get something in that direction; and if we follow in the line of Mr. Foote's paper, I think there is a better future for this Association.

Mr. De Camp: Mr. Chairman, in regard to Mr. Foote's paper, I think he has made some suggestions which will bear looking into a good deal more closely. Like Mr. Morris, I attended the first meeting of this Association, or the second one rather, at New York, for the very reason that he states. At that time there was considerable money invested in the electric light business, and more money being invested, and its main objects seemed to be then to find out how to properly invest the money that was being called into this electric light business. The methods of the Association then were crude, and, if I recollect right, did not take the form of reading papers. Every member got up and said what he felt like saying, and generally spoke pretty well to the point; consequently there was a great deal more talking done than there has been in the late meetings. The result was that I believe that the second $100,000 invested in Philadelphia was invested better than the first. The first was invested on a good deal of guess-work; the second was invested on some knowledge, partly gained from the experience of investing the first ourselves, and what we later had the opportunity of observing that others had invested.

Mr. Coggeshall, of Massachusetts: In the general management of the electric light plant, I find that they make no money, and as it was stated that this paper would be on the economic data, I was in hopes that the gentleman had already discovered a method by which he could show me how to run an electric light plant and make money out of it. Of course the plant which has been operated by the old company was put up in a way that it was impossible to make any money, and they are now erecting a new station; but I do not see any difficulty at all in getting information, without detriment to any company at all; data, for instance, in relation to the coal, the kind of wire used, the durability of the current, and various other matters that would be profitable to every member of this Association. I belong to the gas fraternity, and I have always attended every meeting, and when I found any one else doing any better than I was, it only set me to work to come up to it. That has been my point, and I am satisfied that there can be money made in the electric light business. These statistics, as far as we have got any, in the State of Massachusetts last year, from 75 or 80 companies, showed that there was only five of them carried a credit to profit and loss account; so that the whole thing depends upon the commercial value of running an electric light plant; and it is the data that we want to be guided by regarding their operation.

Mr. Whipple: I may be pardoned, perhaps, if I say that I know something about collecting data. I have spent about $5,000 this year in collecting data. Under the present organization of the Association there are certain matters connected with the operation of the central electric light station that no association nor no amount of private capital could get; yet it is just that information that is of benefit to to the man next door to him—the number of dynamos that a man has in his station, who his engineer is, and who his superintendent is, are of no practical value whatever. The economic principles of that station you never will be able to get, and if we should get such statistics it would be the height of folly, it seems to me, to publish them for the benefit of this Association, because the members of this Associaton are not by any means a close corporation, but are the general public. As far as that is concerned, we are not bound by any oath to keep to ourselves anything that is told us. These circulars, I take it, would be a private, confidential circular of information regarding this, that and the other stations, but I don't see how you can go to work and practically get at this information. You can't convince a man that is running a station whether he is or is not making money; if he is making money he is not going to tell you how much he is making. And, therefore, I should like to see this resolution embody the proceedings of the Convention in a somewhat different form. Before we take the step of forming a committee to do something that on the surface is clearly impracticable, I think that we ought to give more than a cursory glance at it, and find what we can get, and then, after we have got it, find out how we can disseminate it, and who we will disseminate it to. I am not and never have been an operator of a central station, but I take a good deal of pride in gathering data, and I don't like to see the record of the Association cumbered up with a lot of so-called dead letter resolutions, which never amount to anything, and which never will, in the present state of things. If we are going at this thing, let us go at it in a way that we can get some profitable result from it.

Mr. De Camp: There are certain essential costs in the operation of an electrical station. So many matters of judgment enter into the question of costs, you cannot tell what a thing costs without going into details. To illustrate, it is not necessary to say what the lights in this plant or in that plant costs, or what they are selling for. That is private property which I do not feel like spreading before this Convention; but a man comes to me to-day and says: "My lights actually cost me 15 cents a light." Another man says my coal only costs me so much. Now, both of these gentlemen may be right in their conclusions. You cannot draw any comparison between these two men, because you do not know how they arrive at the figures. Now, if you will

formulate a system of keeping those accounts uniform in all the companies, you will have them arrive at those conclusions by precisely the same method. Therefore, if a man says, my coal costs me 15 cents, and another man says his coal costs him five cents, you come right together on the floor of this Convention. Any one who differs from me can go to that particular point. We are both using the same method of coming to these conclusions, but are entirely different. Let us see where we differ. Now, you bring it down to some particular point. It is a waste of time to make the comparison unless you arrive at all results by precisely the same methods. It is the same thing as was here stated about the finding of the cost of coal. Some coals are better worth $1 a ton than others are $2, and yet frequently the engineer says, "I am getting results of so many pounds of coal to the horse-power." It don't mean anything. It is a question what kind of coal you use—if screenings, or clean, hard coal, etc. There is the explanation of it. That is where the value of this report will come in; and I gave some consideration to this subject several years ago. I did think that we could arrive at it by a system of percentages or something of that kind. I think that can be arrived at. If time permitted it—I see the Chairman has me down for remarks on a kindred subject, and I think if we devote the time to it, that we can arrive at some good method of doing that very thing, and I told you, gentlemen, when you do it, I am prepared to say now that a certain part of our work is run the best I know how to do it, and I am not satisfied, and if I can find any other manager who is doing it better than I am, I want to know how he does it. I heard, over and over again, of these things being done with better results than I do them, and it stops right there. I am entirely unable to find out from that party how he does it.

Mr. Morris: I am in favor of that committee being appointed, and I believe it can do some good. They can formulate some of the questions that may be of value; for instance, the gentleman here at my right has asked me a number of questions about my station. I know they could be put in the shape of questions and sent over the land, and their answers would be satisfactory to me, and I am willing to risk the intelligence of that committee in formulating the questions for central stations to answer.

The President: If there is no further discusssion, the topic will now be passed. We will now hear from Mr. M. D. Law, of Philadelphia, on the "Theoretically Perfect Arc Light Stations."

(See eight page supplement.)

Mr. Morrison: Will you please read again, Mr. Law, that paragraph relating to the running of the engines?

Mr. Law then read the paragraph stating that two Corliss engines in his station have been run for seven years at a cost of only $25 for repairs, and that then the only time lost was ten minutes for disconnecting from one engine to the other.

Mr. Morrison: Is it possible that you ran your engine for seven years?

Mr. Law: Yes, sir; for seven years. They were stopped about an hour each morning and on Sundays.

Mr. Morrison: It is a very remarkable performance. Have you been familiar with any other engines than the Corliss?

Mr. Law: Yes, with the Porter & Allen and the Buckeye, about 100 horse-power.

Mr. Morrison: If these statistics are true, they are very remarkable; if they are not true, they are very misleading. Gentlemen who have had experience in this matter, it strikes me, should ask questions about it to see if it is an error. The performance of these engines is so remarkable. I have never heard of such a thing.

The President: The paper is now before the Convention.

Mr. Morrison: Were they run by one engineer all of the time?

Mr. Law: Yes, the same chief-engineer had charge during the whole seven years.

Mr. Morrison: The description Mr. Law has given of an ideal station, is a description of his own station. (Laughter.) It is a very fine station, and it is an infinite credit to to him, but I cannot imagine how an engine, such as the one in the Philadelphia station, could run for seven years without stopping—the paper says run continuously—they never stopped but once, and that was on account of a break down.

Mr. T. C. Smith: I think this is one case Mr. Foote's paper would cover. Mr. Law states that the engines have only cost $25 for repairs. I would like to ask if the engineers, when the engines were shut down, have not done a good deal of fixing up, keying up, putting in packing, etc., which has not been charged up. On the other hand, I understand Mr. Law has a first-class mechanical engineer, who is a sort of consulting engineer, and whose advice or time ought to be charged to these engines, because I am very well satisfied that engines of that type can be kept up to such a remarkably good record, as I know those engines have, without care of any kind, which, while it often seems to be more expensive, is often the cheapest in the long run. The $25 that he counts for repairs, I presume, are outside repairs, as $25 for a new set of brasses or something of that kind. We had one 24x28 that cost us $11,000 for 11 months' run.

Mr. Morrison: We have some Corliss engines, and, while they are good evidence, their result is nothing like that. We have quite a large lot of Buckeyes which give excellent satisfaction. We have also Ball engines, tip top engines, giving the very best of satisfaction, and costing very little for repairs. But they have stopped several times in the last six or seven years. The Corliss engines, as now erected, are the worst of the lot.

Mr. Leonard, of Minneapolis: I would like to state in behalf of the Corliss engines, we have been using one for nearly five years, and one of those engines which we have recently taken down to make room for a larger one, ran four weeks continuously, day and night, 24 hours in a day, without shutting down, except for general repairs and tightening up, some little matter—nothing the matter with the engines. It ran continuously for four weeks, and those engines, outside of packing, which everybody knows will wear out more or less, have not cost more than $25 for repairs.

Mr. De Camp: I think Mr. Morrison is right in saying we want facts. Now, facts are sometimes deceptive, unless we understand thoroughly all the conditions which surround the facts. It is true that the pair of Corliss engines referred to by Mr. Law did run seven years; then ran continuously—we had nothing else to run—for an average of 22 hours a day the year around, with the exception of Sunday, where they shut down about the usual time in the morning and started up in the afternoon. They rested eight hours on Sunday. What Mr. Law means in his statement is this—not that we did not incur the expense of having them well taken care of, nor that they were not subject to a certain amount of wear and tear. When he says $25 he is outside of the mark. That $35 grew out of the breaking of a dash pot rod; but these are extraordinary conditions. They were put in there as 24x28; the cylinders are bored out at 28. Every part of the engine was made from a pattern one size larger; consequently, we are running a Corliss engine 28x48, built on 26-inch patterns. The foundations of those engines cost, I think, about $2,600 or $2,700. Now, I say this: I approved of the specifications for that engine. I approved of the specifications for the foundations against the judgment of the builder, but did it on this basis: The chief engineer says he wants to do this—that is what he expects. For instance, the specifications were made for the foundations; one of the requirements was that they were to be of a certain size; they should be hard brick, laid in pure cement. The lowest bid was, I think, some $2,600. It was from a man who had very large experience in building engine foundations, one of the best men we had in Philadelphia. He came in and made his estimate. He started in and laid two or three courses of brick. The engineer said: "Stop; the specifications call for pure cement." "Well, this is pure cement—a certain portion of cement and a certain portion of sand." "But I want pure cement." "Do you want absolutely pure cement? Well," the contractor says, "I understood this thing the way we generally term pure cement, but what you mean you want is that every brick shall be dipped in absolutely pure cement?" I said, "I do not think it is just the proper thing to take advantage of some individual construction of the engineer," and I called him in and said, "Now, do you mean exactly what this says?" Yet in his judgment it was necessary, and he said, "We want those foundations that way and want that engine to stand, and don't want any after-claps about it." I said, "Then we will have to have it." That contractor told me he never built such a foundation like that before in his life. The borings, as I said, those were all one size larger than the engine called for. Now, in point of fact, there has never been a movement in that engine.

Another thing, we have followed the rule of using first-class oil; I think we are paying 90 cents for cylinder oil and 40 or 45 cents for machine oil for the bearings. The time we shut down it was due to a hot crank requiring adjustment. That part of the expense was not charged for. It was done by our men, by men that we were paying, whether we had them at work or not. It is only now that the chief engineer makes a suggestion to me if he could get a chance to shut down he would like to have them bored out; not that he thinks it is an absolute necessity, but he thinks the time is coming when we will have to do it. But the success of these engines is due to the fact that they were well built, in the first place, well bedded, and that they have had good care, for which we have had to pay.

Mr. Smith: Then you do not consider that it is due to the fact of their being Corliss engines, at all?

Mr. De Camp: Well, I am a Corliss engine man. I do believe this, that you want a Corliss engine in the hands of a Corliss man. That is certain, and they have said to me, "You must have a man to run a Corliss engine who understands a Corliss engine—who is in love with a Corliss engine." Now, as to the cost, I don't mention the fact that we painted the engine.

To come back to the Buckeye engine, we have two Buckeye engines, 18 by 36. In the first place, the Buckeye engines that we ran for five years were run on an entirely different principle from what we were in the habit of running those engines. They were run just as long as they would run. The consequence was that when the time came they made a bad break. When I take a given number of lines and run them on one type of engine, and they consume a certain amount of coal, if I shift that on to another type of engine, and everything else being perfectly identical and they use an excessive amount of coal, the one using the smallest amount of coal, I call the most economic engine. We ran one season and then put in Corliss engines. It was necessary to run them hard, and we put in the old type of Brush machine—40 lights. They did their work all right at 285 revolutions, 100 pounds of steam, 8 by 16. Now, we changed the type of machine to a 60-light machine. That was more of a load than the engine was equal to. We have never run more than 50 lights successfully, and did that by speeding the machine to 300 and carrying the same amount of pressure. We found out that there was economy in the Corliss engine, and further, it was a reason for dispensing with the Porter & Allen and substituting a Corliss or some other larger engine.

Mr. Morrison: What difference do you make in your load, in changing that machine?

The President: I very much dislike to interrupt this discussion, as it is a very important one, and I would like to ask some questions myself. I would like to know how you run a year on $3 worth of oil, and other questions, but as this topic will be continued in the morning, under the head of "An Ideal Station," from an electrical and mechanical standpoint, by Mr. Marsden J. Perry, of Providence, and Mr. John T. Henthorn, of the same city, I think we can very well bear these points in mind and carry them over, and let us then have a general discussion that will end the matter.

Before stating that a motion to adjourn will be in order, I want to announce for Mr. Foote, the chairman of Committee on State and Municipal Legislation, that his committee will meet to-morrow morning at 9 o'clock in Parlor A of the International Hotel.

I will also announce the following committee on the World's Fair: Dr. Otto A. Moses, of New York, chairman; E. T. Lynch, Jr., C. J. Field, Fred Gilbert, and J. F. Morrison, assistants.

Mr. Morrison: I wish very much that you would put another New Yorker on that committee.

The President: I think I have the right man. I trust you will not withdraw.

As a Committee on Electrical Statistics, the Chair would announce: Mr. A. R. Foote, of Cincinnati, chairman. Assistants, Mr. A. J. De Camp, of Philadelphia; S. A. Duncan, of Pittsburgh; E. F. Peck, of Brooklyn; S. S. Leonard, Minneapolis.

Mr. Duncan: Mr. Chairman, I desire to have my name withdrawn from that committee. Statistics are not altogether in my line, and I shall not have time to assist in that matter, and I hope you will substitute somebody else.

The President: I trust, Mr. Duncan, you will serve. You have had a great many years' experience.

Mr. Duncan: I have spent a great many years and have a great many statistics, but at the same time I hope you will select some younger blood who will take an active interest in collecting these statistics.

Mr. Rhodes: Mr. Chairman, is the motion to adjourn in order?

The President: Yes.

Mr. Rhodes: Before making such a motion, I wish to state as to the excursion this evening, it is necessary for those who wish to attend, to be at the Central Depot at 7 o'clock sharp. I hope every one will go, and that they will be there on time. Those of you who have heard the notice please let every person you see, who does not hear the announcement, know about it.

On motion duly seconded, the Convention adjourned until 10 o'clock Wednesday morning.

WEDNESDAY'S PROCEEDINGS.

FORENOON SESSION.

President Weeks called the Convention to order at 10.15 o'clock, and the Secretary read the report of the Secretary and Treasurer, as follows:

REPORT OF SECRETARY AND TREASURER.

New York, July 31st, 1889.

RECEIPTS AND DISBURSEMENTS.

Cash balance from last report	$3,003 82
Dues received from 76 members	1,520 00
Sale of printed matter	2 00
Received from ex-Treasurer W. H. Harding	299 73
Total receipts since last report	$4,825 55
Expenditures as per accompanying vouchers approved by the Executive Committee	3,728 62
Balance, cash on hand	1,096 93
	$4,825 55

The present indebtedness is $259.60, which is part of the funds advanced to the Association by ex-President S. A. Duncan.

The expenditures since the last report may be classified as follows:

Bills incurred previous to the Chicago Convention	$1,483 82
Salary of Secretary and Treasurer, six months	999 96
Clerk hire, month of February	40 00
Postage	127 96
Stationery and printing (not including the Official Proceedings)	234 03
Printing the Official Proceedings	334 26
Official stenographic report of the Chicago Convention	161 25
Rent of office	157 50
Advertising in electrical journals	55 00
Expenditures not specified above	131 84
	$3,725 62

It will be noted from the Official Record of the New York Convention that the account of the ex-Treasurer called for a cash balance of $1,025.23, whereas the present Treasurer has received only $299.73.

The Treasurer would here state that he has received from the Executive Committee vouchers covering the difference between the above amounts. He has also received from the ex-Treasurer, Harding, $34.25, which did not belong to the general

funds of the Association, but was donated by members to the Committee on Patent Legislation. This sum has been turned over to the chairman of that committee.

MEMBERSHIP, INCOME AND EXPENSES.

The number of members in good and regular standing on February 19, 1889, as per official report accepted at the Chicago Convention was 175; new members since that date, 76; making total membership at present, 251.

The membership of the Association has increased during the last year 55 per cent. It has increased in the last six months 30 per cent.

The annual income of the Association is at present $5,020. Its running expenses for the last six months were $2,241 80.

The Secretary: This is the report up to the first of that month. Since that time the Treasurer has taken in several hundred dollars. I have here the vouchers covering the expenses. I have a certificate of deposit of the balance, of $1,950.

The President: The report of the Secretary and Treasurer is now before you. What disposition will you make of it?

On motion, the report was received, and laid before the Convention.

The report of the Committee on Harmonizing Electric Light and Insurance Interests was read by P. H. Alexander, of New York, chairman of the committee. It recommended that the Association form within its body an organization having for its purpose the improvement of the electric service in general, the better education of the workmen, and the improvement of electric work generally. Also that examining boards be formed in different districts, composed of several States, for the examination of men seeking positions as dynamo tenders, wiring superintendents, or other responsible positions and to urge that a certificate of efficiency be issued by the organization. All members should be required to pledge themselves to have all the present employés examined as proposed, and not to employ persons without certificates. By doing this it was felt that the full confidence of the insurance companies would be gained and the service improved.

The President: The exhaustive paper of Mr. Alexander is now before you for discussion.

Mr. Alexander: As I have already stated, there are quite a number of insurance men here that are sent as delegates by different organizations I believe, and who have come from afar, and I hope the Association will have the pleasure of hearing from some of them.

Mr. Morrison: I move that the privilege of the floor be accorded to the representatives of the insurance companies for the purpose of taking part in the discussion. Carried.

The President: The Chair recognizes in the Convention Mr. Barton, of Boston, an old friend, whom we would like to hear from.

Mr. S. E. Barton, of Boston, Mass.: I hardly feel myself a representative of the insurance interest solely; I am a member of the National Electric Light Association, in which Association I take great pride. There are some gentlemen here who are appointed as special delegates; one or two representatives I believe from the New York City Association, and one representative from what is known as the Middle Department Association, covering the States of Pennsylvania, Delaware and New Jersey. There were several others I believe, who were promised, but for some reason have failed to connect; they do not seem to be here.

I think it is pretty well understood what the position of the underwriters is as regards the matter of electric lighting, and I hardly feel that it is necessary for me to take up the time of the Convention with any extended remarks. I think different conventions have been sufficiently bored with my chin music in the past. I am always very glad to speak upon a subject that relates to a new interest; but I feel now that I could yield the time to my brother representatives who are here and who can speak for those organizations which are more particularly interested in the work of this committee, and who have been invited here. We have with us Mr. Anderson of the New York Association, and Mr. Barton, both members of the Electric Lighting Committee of the New York Association, and Mr. Ryan, who is a representative of the middle department. I think the Convention would be very much pleased. I should like very much to call upon Mr. Anderson, and when he finishes, upon Mr. Barton and Mr. Ryan. I know that they are all thoroughly in sympathy with us.

Mr. Boughton: I will not consume the time of the Convention in entering again upon the branch of the subject that has already been covered. The situation of the boards in New York is very peculiar and different from that of any other organization; and while we may not be able to pledge ourselves as far as some other boards may feel themselves authorized to commit themselves, it is only fair to say that we have worked for several years in the interests of good practice in the solution of electric plants, and we want to co-operate with the electric light companies, and will cheerfully co-operate with the electric light companies in furthering the good work, and will go as far in the matter of safety as the companies themselves are willing to go. They cannot be too safe for us, and we will gladly enforce, as far as the rules of our board will permit us, the most stringent regulations that can be laid down. I say this in our behalf, but our jurisdiction is over very limited territory, the cities of New York, Brooklyn and Jersey City. We should be very glad to meet a committee from this organization, and see if we could not agree—I believe we could agree—upon details for the proper conduct of the business of electrical companies and ourselves that should be satisfactory to both in the city of New York. (Applause.)

Mr. Anderson: We find in the city of New York that our architects are entirely ignorant of what should be done in the construction of electric pipe plant in a building. They have the underwriters, but without consulting the underwriters they have made their specifications, and made their contracts for electric lights in accordance with our rules.

The discussion that followed was quite generally participated in, but elicited little that was new. The following was finally adopted:

RESOLVED, That the Committee on Harmonizing the Electrical and Insurance Interests be continued, and that it invite the insurance interests to a conference, for the purpose of establishing electrical exchanges throughout the country.

Mr. Charles A. Brown, of Chicago, offered the following:

RESOLVED, That a committee of three be appointed by the President, and instructed to prepare and present to the proper committee of Congress, a petition on behalf of the National Electric Light Association for the abolition of the custom's duty on copper, ingot, wire plates, sheets, bars and rods.

The motion prevailed, and the President appointed as the committee Messrs. C. A. Brown, Geo. M. Phelps and J. F. Morrison.

The paper, "An Ideal Station" (see supplement), was then read by Mr. Henthorn.

The Convention then adjourned to 2.30 P. M.

AFTERNOON SESSION.

President Weeks called the Convention to order at 2.20 o'clock, and introduced Mr. F. A. Wyman, who read his paper on the "Unconstitutionality of Electrical Executions." This was followed by the

ADDRESS OF DR. OTTO A. MOSES ON "ELECTRICAL EXECUTION,"

who spoke as follows to a large audience, a number of visitors being present from Baltimore:

We all have a very deep interest in the subject which has been just broached by Mr. Wyman of Boston. I did not have the pleasure of listening to all of his paper, but I think in one or two sentences he laid very clearly before us what his belief and his proof was that killing by electricity is a cruel and unusual punishment, and therefore violating all the constitutions of the different States of this country. That is a view that I think will prevail ultimately, and lead, as we hope, to a repeal of this very obnoxious law that is now agitating our press and our people. That law it would be well for us just now to consider in its history, and then I will offer a few remarks upon statistical information which I have gathered, owing to the kindness of the various members of this Association, and of others even not connected with it, and then we will proceed to show that the main object of the law is violated in the act of carrying it out. That is to say, the object of the law was a philanthropic one. The method by which the killing is to be conducted is one of the most barbarous that could possibly be devised, and therefore altogether unnecessary. Two years ago, many of us, I among the number, received from Mr. Elbridge T. Gerry, the noted philanthropist of New York, a communication, in which he requested some opinion or expression of views on a proposed law of killing by electricity. But I happened to be away, and though he once or twice wrote to me after that, I never received his letters, and consequently did not participate in the deliberations which led him finally to recommend to the legislature of the State of New York that hanging should be abolished and killing by electricity should be substituted for it. The law was put upon the statute books, but very soon it became apparent, however, that it was a hasty proceeding; we, meeting at our several Conventions, were too much occupied with the useful and the practical side of our art and science, to engage in any considerations of such a far-fetched use of electricity as killing. The result was that we allowed the law to go almost unnoticed upon the statute books, and finally, when the time came for a criminal to be condemned, we were ourselves placed in that awkward position of representing an interest, the chief instrument of which was to become a public executioner. It seemed as if by an instant revulsion of feeling we became conscious of the fact that some one or other interest had been at work for the purpose of bringing opprobrium upon electricity. That was considered far-fetched in the beginning, but afterwards, when we saw the precise methods, the cruel calculation, the persistence of certain individuals—I might say one individual—constantly bringing before the public the fact that the law had to be executed, and then finally trying to concentrate it in such a way as to bring a further opprobrium of deeper dye, as it were, upon one branch of our beloved art and science—when we saw that, we were aroused. The result was, that by a sort of spontaneity of action, protests were sent forward. The first criminal who was condemned to death under the law was not killed, but an effort was made to prevent his death, and he is to-day in that most unfortunate position. Only recently at Buffalo the matter has been argued after a prolonged hearing before a referee in New York, and a most enormous amount of testimony of a very conflicting nature has been brought to bear. It is a sad thing that we have conflicting testimony, because the fact that certain experts gave their opinions *pro* and *con* has been taken by the press to convey the idea that an uncertainty has existed in the minds of those who use the current in great quantity, as to its killing effects.

Now, this action in New York and in Buffalo has led to a simultaneous effort on our part to bring this matter before the Convention for deliberation. In order to have information for the Convention, a letter was addressed to every manager of a central station in the United States, to the number of over 800, requesting him to give information on certain very important points.

If now electricity was to be used as a killing agent, it should be a certain agent. I will not go into the question of its mercifulness, because from the collaterals which I will present later you will see that instead of being a merciful agent it is the most cruel and dreadful agent imaginable, and for that reason alone the law should be repealed. But aside from that, its uncertainty is the element that ought at once to condemn it as the means of public execution. I received from these 800 circulars which we sent to the different companies several hundred answers. They have been closely scanned, and they were directed to me up here. I have for the last two nights as closely as possible perused their contents, and I have come to certain conclusions, which I will state to you briefly.

As some statistics of these I may say that I have received replies in which I estimate that there were 73 accidents that happened in central stations. Of this 73, nineteen were due to the alternating current, the balance to the continuous current. The questions that we asked bring out some very remarkable information, and I have from this numerous list of answers collected some here, which are open to members of the Convention. I will read some of the remarks which show that the sensation produced by heavy currents not sufficient to cause death, is so dreadful and so various that I think I can safely say that an examination of these papers will not be able to controvert it, that no two people agree as to the exact symptoms, that is, they had not the sensation. For instance, it is clear that the action of the current upon one man was like cutting him in two with a buzz-saw; another one says it was like striking him on the back of the neck with a sledge-hammer; another, like knocking his brains out with a trip-hammer; another said that he felt himself full of needles; another, as if he had fallen from an immense height and had been dashed to pieces upon the ground; another, as if he had been smashed. So that altogether you will see that the symptoms are different in all individuals, and all accompanied with the most dreadful sensations.

Now, if this law has been passed, it brings an obloquy upon our profession—if that law is to be enforced, we will be bringing to bear upon the prisoner a punishment greater than any devised during the time of the Spanish inquisition.

There they had numerous punishments, but there was nothing that simultaneously tortured every nerve of the body. They would put them upon the rack; they would draw you apart, limb from limb; they would put you on the horse; they would tie you by the thumbs; they would pluck out your eyes. But they never took every nerve in your body and put it upon the stretch in one instant. I look upon the execution by electricity as one of the most dreadful concoctions of a barbarous mind.

Now, gentlemen, an effort has been made, and a persistent one, to bring this about. I have looked around in many directions for a case of this kind, and when I see that every citizen of New York and all of our large cities to-day fears to touch a wire, that they pass hastily under an arc light wire that is stretched across the street, that they shun it, that they feel, as I have been told, that when they are introducing an electric wire into a house they are in contact with the same instrument that is to deal death upon a criminal, when they feel in that way, I say that such feelings will result disastrously to our interests.

We should, with all the energy that we have, push forward and try to prevent this. Those who are inimical to us, spread such reports and make such efforts as to bring our electric current into disrepute. As warnings have been disregarded in the past, but in the last few weeks since the newspapers of New York have been speaking so much of execution by electricity, I have taken occasion to inquire as to the public feeling, so I may say, the private feeling. Not that that comes into the newspapers, but I begin to see that there is a certain fear being attached to the idea of an electric current. That is something that we must avoid if possible. Let us not have electricity served as a public executionist. Let us go before the Governor of this State where the law exists and ask him to repeal that law. We are the sufferers, and must influence the Executive Committee of this Convention to take some cognizance of this thing before it is carried to an execution.

There is still another thing that I would say. I do not see in this hall one face of one man who would venture to apply such a thing as an electric current for purposes of death. We are here for the purpose of advancing the uses of electricity, to make it rejuvenate the world, to carry it forward as a civilizing agent, not as an instrument of torture. I doubt whether there is in this broad country one reputable engineer—electrical engineer—who would deign to connect his name with the application of this death-dealing instrument to the purposes of public execution. When Mr. Elbridge T. Gerry in his pamphlet said that he had consulted physicians for the purpose of finding out whether prussic acid, or morphine, or strychnia, or chloroform might not be used, and he met with the universal reply that not one physician could be found to administer any of these death dealing agents. Shall we be placed in the position that one electrician can be found willing to administer our current for the death-dealing purpose? I deny that such a thing should be and yet we hear that at this moment, while we are here in convention, there is one at the Penitentiary in Auburn who is experimenting on animals, preparatory to the administering of that current to that criminal Kemmler.

I say let us here condemn that action. It is impossible for any one, by experiments upon animals, to be able to say that what has been done with them can be done with equal effect on human beings. Let it not be trumpeted over this country that the dying groans of that criminal cursed electricity with its last sound. Let us not allow it to be said by the papers that we have been introducing that which has become a public executioner.

This thing is not a new thing—this effort to introduce electricity for the killing of human beings. It was thought of from the very day of the discovery of the Leyden jar. The first man who discovered the Leyden jar did so by means of a violent shock, so violent that at the time he said he would not repeat it for the crown of France. It was very soon thought after that that electricity could be used for killing criminals, and so philanthropic a man as Benjamin Franklin (in this respect the equal of Mr. Gerry), so philanthropic a man tried experiments upon animals in order finally to be able to apply it to the killing of human beings. But he had a most unfortunate experience. Benjamin Franklin killed turkeys and fowls and dogs, and on one occasion he had killed a

turkey, and in the excitement of the moment he accidentally touched the conductors of the machine and received a shock himself, which he described as something terrible, and that he would not repeat the experiment. You will see that my statement that the pain attending the administration of electricity must be something most horrible, is corroborated by this. Benjamin Franklin was looking at his hand at the instant that he felt, as he describes it, throughout his whole body, an universal blow. He was, in fact, knocked senseless, recovered, was in great pain throughout his whole body, and he was told that he had been struck by the current. He was told also that the spot he was looking at was where the current had entered his body. He examined his hand and found upon it, as corroborative of the statement, a puncture and an elevation (as he describes it), the size of half a pistol bullet. He did not hear the sound of the discharge of the Leyden jars by which he was struck, although by some it was declared that it was as loud as the sound of a pistol, and though he had been struck by the spark which others had seen and which others had heard, he was neither conscious of it by sight nor hearing, while he felt throughout his whole system an universal blow.

Now, gentlemen, I think it will be impossible for us to determine what the amount of pain is that attends an execution by electricity. Those who have come back to us from the borderland that separated them from the eternal life have said that they have felt the tortures of the damned. And yet they recovered within a very short time, sometimes within hours or days. Now, what must be the agony that would cause death? There is not one going to come back from that bourne from whence no traveler returns to tell us of his sensations. Let us judge by what we know. If an explorer should go into a distant land and on his way should meet with such obstacles and dangers as to deter others, would we not be safe in surmising that greater dangers were beyond? Such is the case here We find, as a general experience of all those who have suffered from electric shocks of great intensity, that the pain is most intense. Therefore, why should we not expect that the execution of an individual would be accompanied by still greater pain. The object of the philanthropist is to put him out of the world without pain. I have my doubts as to whether that is desirable, but if they once state their position clearly, that their object is a philanthropic one, we can only discuss the question on that platform. I think, in passing, I would say it, that pain should, to a certain extent, accompany punishment. We pass through life, and when we approach the final day, we find ourselves racked with pain. Nature provides that we should come in and go out of the world in pain, and why should these gentlemen, the philanthropists, say we must go out of it after having committed such crime as deserves death—why shall we go out of it painlessly? I think that is a most mistaken philanthropy. There must be a certain punishment attached to crime which will deter others from engaging in the same crime. But that is neither here nor there.

We have in this case upon our statute books, a law which is a most obnoxious one. Fortunately for us, a man of talent in New York has, in a disinterested way, engaged himself earnestly as the champion for us, in order to bring about the delay of that puhishment, to stem the tide in order that the legislature may think once m ore, and then perhaps repeal this law. I think to Mr. Bourke Cockran, of New York, we owe, gentlemen, a certain consideration, and he deserves our praise for the manly way in which he has opposed some of the most brilliant names connected with electrical science—how he has manfully struggled to defend our interests from this obloquy. I would say, gentlemen, that now is the time for us to call to the attention of the authorities the iniquity of this law; first, as being a barbarous practice; second, as interfering seriously with a rising industry that some day or other is bound to be first in this world. And now, let us not nip it in the bud; let us not check this growth which has been so fair financially, and for that reason I would offer a resolution which embodies the views I had thought of, and which has been put in form by those who have been considering the legislation of the country in connection with electricity. This resolution I will read.

WHEREAS, The law requiring the execution of criminals by electricity, enacted by the General Assembly of the State of New York, was enacted under a misapprehension of its philanthropic importance; and

WHEREAS, The National Electric Light Association regards such a law as an unnecessary degradation of the most useful natural agent that science has ever rendered available for the service of man; be it

RESOLVED, *First*, that the National Electric Light Association does hereby respectfully petition the General Assembly of the State of New York to repeal said law at its next session. *Second*, that in view of the inexpediency of said law, and until it is repealed, the Governor of the State of New York be requested to commute the sentences of all criminals condemned to be executed by electricity to imprisonment for life. *Third*, that a copy of this preamble and resolution be forwarded at once by the Secretary of the Association to the Governor of the State of New York. *Fourth*, that the proper officers of this Association, and that the Chairman of the Committee on State and Municipal Legislation forward a copy to each member of the General Assembly of the State of New York at its next session, together with copies of such papers as the Committee may have at its disposal urging the repeal of said law.

Mr. Huntley: There is in our midst a gentlemen who, by the papers this morning, has been assigned as assistant to Harold P. Brown, Dr. Fell, of Buffalo. I ask that he be permitted to have something to say in this Convention regarding this matter.

Dr. Fell: I came to this Convention to listen to the address upon the subject of electrical execution. I expected I would find considerable opposition to it on the part of you gentlemen engaged in the noble work you are doing in advancing humankind by this wonderful and valuable agent. I am only a physician. I am not interested in any electric light company, not interested in any way, except probably as a scientific man, in the advancement of everything pertaining to the welfare of man. I was called to make some experiments at Buffalo with this powerful agent, with the view to deciding, when the question should come up, what was the best and speediest and most humane agent we could use in the execution of criminals. Now, gentlemen, cannot we advance in this line as well as in others? From the demonstrations which I made, I could not help but come to the conclusion that there was no agent we had at our command which would execute criminals with such rapidity and without question of pain. I am satisfied that the experiments, so far as I am concerned, demonstrated that what could be done upon the lower animals could be done upon man. The question is, Do we want to have the horrors of hanging kept up? We see it in newspaper reports all over the country every day. I feel that the use of electricity for the execution of criminals is not going to have the effect which you gentlemen think it will have. I do not see how the use of this great agent as the instrument of execution, could affect the welfare of mankind, and their progress in their inventions. I think that we will do away with the horror attending execution; that the use of electricity will do away at once with this horrible condition of affairs. The accidental executions which have been taking place all over the land for some time, demonstrate the question of its success. I may not look at it from the same point of view that you do. I wish I could. If I thought for one instant that the use of electricity in the execution of criminals would retard electrical progress, I would say do not use it, but I say if it is an advance, then let us use it and do not try and stop us from using it.

Mr. Pope: Dr. Fell, in the use of prussic acid, is there any method known to science as will kill a man as quick as prussic acid?

Dr. Fell: I think there is probably nothing but electricity.

Mr. Pope: Does it require the use of harness, the adjustment of apparatus—does it require any preparations?

Dr. Fell: As to that, I do not think that electricity requires that.

Mr. Pope: It does, sir; it requires a very careful preparation. Another thing: Did not the Medico-Legal Society resolve that the use of any method in their practice would affect their interests?

Dr. Fell: As to that question, I would say that is merely the opinion of a body of men. Whether it would or would not I cannot say. If it would, I should say do not use it.

Mr. Morrison: Who do you think would be the best judges of the effect it would have upon the physician's practice, that body of men or some other body of men who did not use or knew nothing about it? The physicians gathered together, and decided, as Mr. Pope suggested, that the use of any method in their practice as a means of execution would be detrimental to them. I ask you what body of men would be best qualified to judge as to what would be injurious to the practice of their profession as physicians?

Dr. Fell: The physicians.

Mr. Duncan: When you answered the first question, you said probably—what do you mean to convey by that word probably?

Dr. Fell: I am only basing my statements upon my own observations, and I believe from those observations that execution by electricity can be made instantaneously and that there will be no sensation.

Mr. Duncan: That is your belief. Now will you give us the facts on which that is based?

Dr. Fell: That is corroborated by the numberless executions accidently taking place throughout the country already.

Mr. Duncan: What do you mean by numberless?

Dr. Fell: Several hundred, probably.

Mr. Duncan: "Probably," there is the same expression again. We are dealing with facts here.

Dr. Fell: I seem to be in a minority.

Mr. Duncan: If you rest your case upon that, I am perfectly willing to leave it.

Mr. Pope: I would like to ask the gentleman in reference to gas; which has killed more people, gas or electricity. Is it not a fact that a week or two ago a new method for the destruction of animals was introduced in the city of New York, and that that was publicly mentioned in the papers as a more humane method of despatching dogs than the method heretofore prevailing, that is, the introduction of gas in a sealed box, whereby they receive a painless death?

Dr. Fell: I can answer that, Mr. President, very readily. Possibly, the use of gas or any means of that kind to produce gas is painful during the first inhalations—very painful indeed, until a man is asphyxiated—until asphyxiation takes place, and that gas would be more painful than electricity on account of the nerve current being so much less than the current of electricity.

Mr. Wyman: I want to say to you, gentlemen, members of the National Electric Light Association, that if you have got a particle of spunk in you, it is time to bring it right out, but if you want to go down and have your whole society and profession—I call it a profession—killed financially, then you want to allow this execution to take place. I tell you you are scaring all the men, women and children in the United States by allowing this to go on. You are fixing it so that my wife does not dare to have it come into the house. I got her, about 10 or 12 years ago, so she would allow a telephone to be put in, but you are fixing it so that I cannot have an electric light. These men who come in for the purpose of striking at one part of your trade—you have got to stop that. I tell every manager of an electric light station here, every manager in the United States of America, who wants to increase the income from his station, that the time for him to put his force at work is now, and to try and stop this man from being killed. You cannot do it by passing resolutions; you can do it by personal appeals to your governor, which you must make if the courts decide that the law is constitutional—I do not believe they will—then it is for you to go before the governor, not with resolutions, but send him carloads of delegates, go yourself, say: "Here, this strikes our pockets; it is the case of gas against electricity; it is the case of one man with one kind of a current against another man with another kind of a current;" and I say to you right now, be men. Do not fool around with this any longer, but go there by carloads and lay right down on your governor, so that he has got to commute that man's sentence.

Mr. Alexander: The doctor from Buffalo stated that so and so many executions had taken place throughout the United States, or probably meant that so many people were killed by the electric current. Before a committee appointed by the Legislature of the Commonwealth of Massachusetts last winter, the question of overhead wires came up, and experts testified on behalf of storage battery companies against experts on behalf of overhead railway companies as to the danger or lack of danger in overhead power wires. A gentleman whom you all know came up as an expert and testified. The attorney for the storage battery company brought in an affidavit from this party—it was not known that he was in the room then—wherein he testified to an enormous number of deaths having taken place by overhead wires. The chairman of the committee called for the gentleman—and I will mention his name, Mr. Reise, of Baltimore—a young man got up and said he was the gentleman. The chairman said: "You have here testified under oath that you knew of so and so many people having been killed by electricity—state one, please?" "Well," he says, "in Baltimore a man was killed by coming in contact with an arc light wire." "State the circumstances, please?" "Well, I do not know them." "You do not know them," says the chairman. "Then you were not present?" "No, I was not present." "Well, where were you when this occurred?" "I was in Boston." "How did you know this man was killed?" The young man said: "I was in Boston, and I read it in the paper." "State some other cases that you know about." "About a year ago a man touched a lamp in the Bowery in New York and fell dead." "What proof have you got of this?" He took up the so-called "red book," which was called a firecracker here at the last Convention, and also opened up Mr. Harold P. Brown's pamphlet, and said: "I have read it in these two circulars here." "And that is all you know about it?" Another gentleman testified on behalf of the State at the Kemmler investigation the other day, as to the intense danger of electric currents and the possibility of killing. That very same man, less than six months ago, before the same committee was retained by a storage battery company to testify that there was no danger in overhead wiring, no matter what the current, whether of high or low potential, and even if the wire was bare. The gentleman states there are numerous cases. I have here a case myself. Harold P. Brown, in a letter in the New York *Post*, dated July 5th, says a number of persons were killed by a certain kind of current. Telegrams were sent to these parties and replies received from them, showing that the statement is not true. One case amused me very much. It was that of a man of about whom I wrote to Mr. Brown the same day regarding the facts. The man had touched a wire and fell, face downwards, in eight inches of water while intoxicated, and was drowned. These things all show that these statements want to be carefully investigated.

Mr. De Camp: I want to ask Dr. Fell, the statement having come from him that several hundred persons had been killed—we won't question the number—and that they were killed instantaneously. That is the strength of your position, that particular point. That is the only evidence you say that you have. You assume that it can be done scientifically, without pain.

Dr. Fell: From my own observation.

Mr. De Camp: What evidence have you that these two or three hundred people were killed without pain; how do you get the knowledge?

Dr. Fell: I can answer that question. Helmholtz has demonstrated that the electric current passes—or Wheatstone has demonstrated it—at the rate of 280 miles per second of time. It has been demonstrated to the mind, and it is now accepted by physiologists that the nerve current passes at the rate of 111 feet per second, or that it is 3,000 times less rapid than the electric current. Now, when the nerve current is that of sensation when we pass the electric current through the body, is it possible for the nerve current to overtake it?

Mr. De Camp: That is not the question.

Dr. Fell: Some people can ask questions that even doctors in Buffalo cannot answer sometimes.

Mr. De Camp: I want to say I know of one man being killed, and he was killed unquestionably; but from all accounts I could get, that man in being killed suffered very considerably. It was not a painless death that he received in that case. All these cases—I am not going out of the particular range of cases you mention—occurred under such peculiar circumstances that nobody, I think, is warranted in saying that this is any evidence whatever that these deaths by the electrical shock such as received and reported in the papers are painless. On the contrary, I think we have every evidence in favor of their being the opposite.

Dr. Moses: Dr. Fell has touched upon a very interesting point, and one which can be settled and has been settled on just such fragmentary testimony as I gave a while ago in my remarks. It is admitted that the

speed of thought as representing the rapidity with which a current can pass along a nerve, is about the seventh of a second in the length of the human body—about 100 feet a second. Now, there is no more accurate observer on record than Benjamin Franklin. There was no man more careful in a statement of facts, and I can elucidate it in just such a way as this—that when Franklin was on the eve of discovering the real reason for what is known as the Faraday experiment, he, with wonderful power of self-restraint, said, "This is an hypothesis, and I will therefore not go any further." Such a man deserves the greatest respect when he allows to issue from him a direct statement. Franklin said in that experiment I refer to, that he was looking at the spot where the current entered his hand. The distance could not have been more than a foot or two, and yet he did not see the spark, though light travels 200 miles a second. Nor did he hear the spark which people said was as loud as the crack of a pistol, and yet he felt a universal blow. That was the current of thought—that spark. The impression of it did not go to his brain, but yet the reflex action when he recovered consciousness led to its being impressed upon the brain. Why shall we say because a man cannot come back from the borderland and tell us all his sufferings, that we know whether or not he has suffered, when we know that those who have returned have had the most intense agony.

There is one other point. We have all through the body little brains; all down the spinal column there are little collections of nerves leading to all parts of the body, that are, as it were, rudimentary brains, to such an extent that if you were to take the brain out of a rabbit and put your finger into his mouth, the brain that as a young rabbit would cause it to suck, acts. You will feel upon the finger the sucking action due to the action of this ganglion, which controls those muscles. Now, there is a case of no brain, and yet an action as the result of thought. It is true that if the brain be paralyzed, nevertheless throughout the whole body each nerve can be a thinking brain for itself, and able to give its own cry. I have just been told by the gentleman at my right that he has seen a death by electricity. That the man's cry could be heard for blocks, and yet there was no doubt of that man having been killed. Was that a mere spasmodic action? It may have been so, but I doubt it. I think it was the united action of every nerve in his body calling for help at that moment. (Applause.)

Mr. Garratt: If there is any one thing in regard to this discussion which we are anxious to have, it should be to have a fair statement from experts to go upon our records. In answer to a question by Mr. Pope, I understood Dr. Fell to say, speaking of death by gas, that in the preliminary stages before intoxication took place, before asphyxia took place, it would be very painful. I should now like to ask the doctor if, of necessity, the asphyxiation need take place before the execution? In cases of gas you take the simple and familiar example of nitrous oxide (I might name a dozen others, any chemist will be familiar with them), where intoxication takes place first, where the direct action upon the cerebellum is the first thing which happens. I doubt if there are many people in this hall who have not become unconscious voluntarily more than once by the nitrous oxide that is known as laughing gas. Also the effect of vapor of ether, chloroform, which is somewhat painful, although we subject ourselves to it.

Mr. Degenhardt: I think these deaths are due in a great part to sudden fright. I refer to a case which came about in this way. Being in search of a gang of men to work in a basement, I walked into a dark place under the sidewalk and against a bunch of wires carrying a current of 210 volts. Immediately I struck the wires I dropped to the ground and did not come to until fifteen minutes afterwards. I decided that I had been scared to death. My experience in the matter was confirmed by the fact that a few days after I went into this locality and I handled this current without any difficulty at all. Possibly, a great many of these deaths can be traced to that action. In one case, Mr. Brown of Chicago will probably recall the case, a man was on a ladder and had hold of one support of a lamp. He reached out with his other hand, his foot slipped, and he grasped the side of the lamp and the man was shocked and dropped to the ground and broke his neck. There was no evidence that the current destroyed his life. His neck was absolutely broken. The man cried out for help. We were too remote to afford him that help, and the coroner's jury brought in the verdict that his neck was broken. I am satisfied that from his long experience and knowledge of his business, it was a pure case of fright. He relaxed his hold when there was no necessity and dropped to the ground.

Prof. W. A. Anthony: (Applause.) Mr. Chairman, I have only a word or two to say. In the first place, in regard to the velocity of electricity. Dr. Fell made the remark that it was well known that Wheatstone demonstrated that the velocity of electricity was 280,000 miles per second. All of us know that such experiments were unreliable, and that it is now perfectly well understood that it was not the velocity of electricity at all, but simply the time required for those wires to be charged, and for a spark to leap across the gap between the two wires. (Applause.) The velocity with which electricity passes over any given conductor is not known, and we know that that velocity depends upon a thousand things. In the first place, it depends upon the conductivity of the conductor; in the second place, upon the amount of pressure or potential; and upon many other things. The fact is that in the nerves of the human body the velocity of the electrical current is known to be immensely less than it is in a metallic wire. In a wet string, the velocity of the current in passing over even a space of a few feet, is readily measurable, requiring quite a large fraction of a second to pass over a distance of even a few feet. I merely speak of this matter that it may go upon record, if these discussions are to be reported, that this question of the velocity of electricity cannot settle the point as to whether the death by electricity would be painless or not. I want to say a word in regard to another point. An execution of the death penalty, it seems to me, ought to be by some method that would not require experts. Now is it possible, and is it likely and will it ever be possible, to have an electrical execution without bringing in electrical experts to prepare the apparatus and prepare all the paraphernalia, before the execution can be performed? Would any one not familiar with electrical apparatus be competent to adjust the apparatus and make the necessary arrangements, even after the execution had been performed successfully once, twice or even 10 times, by means of a given apparatus, would you then be willing to allow your sheriff at the next execution to put that apparatus in order, place the electrodes and touch the button which was to produce death? Would you find a sheriff anywhere in the State of New York that would be willing to take that responsibility upon himself? Could you find a sheriff who would be willing to fill this position? I doubt, if after 100 years have passed, electricity will be so understood by non-experts that they would be willing to take the responsibility of performing that act. Now, I say that an execution ought to be performed in such a way that the men whose duty it is to perform it according to the law will be able to perform it without calling in two or three experts. (Applause.)

Mr. Morrison: Our business requires that we should state our objections to the use of electricity for executions; that these petitions should be divested of all flowers of rhetoric and all technicalities, and put in good, plain, straight English. I think that the case in hand ought to be treated from another standpoint, the standpoint of where this idea of executing criminals originated, and what was the motive of those who pressed it upon the government of the State of New York. I did not desire, nor do I now desire, to take a part in the discussion of this question. I have given the matter little or no thought, but so far as I have learned, it was not a question of dealing kindly with the men you are going to deprive of life. It was not that the criminal might die a painless death. It was not that a benefit should be conferred upon the people of this and of other countries. It was to enable an individual to advance his private interests, and gratify his personal malice in pitting one system of electric lighting against another system. (Applause). That is not a laudable ambition. Even if that gentleman should be elevated to the high rank of the Executioner of Paris, I doubt if it would pay him for the contempt he will earn for himself from the men whose profession he soiled. A set of statistics were furnished here which read something like this: So many men killed by falling off a cross-pin, and breaking their necks on the pavement; so many men by runaway horses; so many by explosions; so many by flies getting down their throats and choking them to death, and so many killed by electricity. And amongst the deaths quoted, there was no business, and there is no business to-day, conducted on a scale of equal magnitude with that of electricity, that presents so few fatal accidents. (Applause.) In the city of Baltimore, we have had two accidental deaths in nine years. A light went out. A stable boy connected with the electric light station, in passing from his work on a terribly stormy night, saw that this light was out. He climbed the pole, and had heard the men say that by separating the carbons the light would go on again. As usual with men in going up a lamp post, he threw his leg through the framework supporting the wire, and he also came in contact with the guy wire connected with the ground. It was a very stormy night and probably some fault was on the wire. The man was killed. Another instance was where a man was connecting up a live circuit, a thing which we are all apt to do at times when necessity arises—he ran the service wires in the building, brought them out through the main line, and for some reason he handled the end of the wire with his hand with the pliers, reached forward and cut the main wire, I suppose expecting to secure it afterwards. The man was killed. That was a skilled lineman, who understood his business from beginning to end, and knew all the dangers of it.

I rose to say that, of course, electricity will kill. Anything that has power will kill. Anything that has not power is of no use to man. (Applause.) I would have pursued this course from the beginning; I would ignore this man who has attempted to place this blot upon the profession which he has disgraced. (Applause.) This law is upon the statute books of New York. It is with you to-day, and it is incumbent upon the electric light men of New York to get rid of it. It is incumbent upon the members of the National Electric Light Association to do everything in their power to get rid of it. Do everything that you can do to open the eyes of the Governor of New York so that the case may be presented to your next Legislature, and enable this disgraceful law to be wiped from the statute books of a State which stands foremost in the civilization of this butt-end of the nineteenth century.

Mr. Morris: Pardon me for making a short talk on the subject, but I cannot permit this discussion to close without saying that I question the wisdom of the action that this Association has taken on this proposition. I say that we ought to look the facts in the face just as they are. We cannot say that electricity will not kill. It will kill. So will a steam engine, and, as Mr. Morrison says, every power useful to man, if properly used, will kill. Now, I question the truthfulness of the statement that it is a degrading use of electricity to use it upon the criminal. If we can bring painless death to the criminal, then we are doing a philanthropic act, and then you are ennobling the use of electricity and not degrading it. A man who makes the rope might properly say you are degrading his business to hang a man with the rope. Now, I recognize the fact, alluded to so forcibly by Mr. Morrison, that this whole business grows out of the rivalry existing between two businesses—the low tension system, direct current, and the high tension alternating current. I am willing to say that the alternating high tension system will kill. Certainly it will kill. Suppose it does? As I said a while ago, the steam engine will kill. Still, while we smart Yankees are feeling our way along with a 1,000-volt current, our slow English brethren are putting up a 10,000-volt current, or 10 times as strong as the one we are using. If a 1,000-volt current won't kill this man, let us make a 10,000-volt machine. I do not know any better place to begin than upon this man. Let us begin and experiment with this one, and then with the next one, and if we run out of criminals, then we may take Mr. Brown himself and experiment with him.

Mr. Duncan: In regard to the painlessness of this current, I know of a man who has received two shocks. In one case he let down a lamp running from a 50-light 2,000 candle-power machine. He was working on the wire, when it dropped to the ground and burned through the insulation to the ground. Without thinking, he stepped back and picked up the wire, when he broke it off close to the lamp. He was standing on the ground saturated with water. Of course, that passed the entire current through his body, and where the wire struck his hand it bored a hole in his hand clear to the bone, and he became unconscious. We finally released him from the wire, and when he came to consciousness and recovered I asked him what the sensation was. He said, "There is no language that can describe it; it is beyond human language to describe the feeling of agony I suffered in the short time I was connected with that wire." There is a case where a man has received this shock and knows what the feeling is. Of course, if it makes him unconscious, and he feels the shock before he becomes unconscious, there can be no question about the fact of his sensation.

Mr. Law: I have been knocked insensible several times. One of these cases was one in which I opened a circuit—or the circuit was opened through me by the carelessness of one of my men, to a 700-volt current through my hands. I laid insensible at that time ten minutes they say. The other most important case was one in which I shunted the current on a 60-light Brush machine through my hand. At that time my first realization of any sensation whatever was the watching of my hands. The first thing that came to my notice at all—I was drawn all out of shape - I was watching and wondering if my hands would ever come into position again. Gentlemen, I don't want to go through that experience again. The pain was torturous; it was terrible. In the case of that man of whom Dr. Moses spoke, of course the current passed through from hand to hand. I have had it from the hand to the foot. In the case of this man, who was unfortunately killed, the current entered at the temple, passed through to the left hand. Now, I think that current, a current from about 50 lights, undoubtedly was very close to the brain. That man hollered so loud that he could be heard about three blocks; his hollering was what brought the men to the pole. But he was unquestionably dead, because in the doctor's examination of the body in the coroner's testimony I find that the blood was white—it was turned to water; the current was taken off immediately, so that there was no lingering current after death occurred.

Mr. Lynch: Mr. President, I think it would be a great deal more fitting and courteous and bear a great deal more force if the Association is to present the petition and resolution as presented by Dr. Moses, that they should be presented by a committee of this Association, and I would move that a committee be appointed by the Chair, of which Dr. Moses should be chairman and Mr. Wyman one of the members, to present the preamble and resolution to the governor.

Mr. Huntley suggested making it a larger committee, so that it would carry a great deal more force.

Dr. Moses: I would suggest that our vice-president, Mr. Maher, who is in Albany, be added to that committee or made the chairman of it.

The motion to adopt the resolution was then put and carried.

Mr. Morrison: It has been suggested by the Hon. Mr. Ely, with whose name you are familiar, he having delivered the address of welcome, that a transcript of these proceedings, so far as they relate to this case, be furnished the chairman of that committee. That is to say, all these experiences such as Mr. Law and other gentlemen have given here in relation to things they have seen and heard, be furnished to the chairman of the committee, and that they send them to the governor and see what effect it would have.

Dr. Moses: I would like to say that I have an armful of responses that would almost fill the governor's private office, from members of the National Electric Light Association, giving all the details, and if he takes the trouble to read these that I have taken to collect them, he will rise from the perusal with a horror that will not allow the ink to dry upon his pen before he signs the papers for the repeal of the law.

Mr. Morrison: The point is that that testimony is not the testimony of the National Electric Light Association. If you take the transcript of the records furnished from these members, it will have a better effect.

Mr. Walter C. Kerr, of New York: I rise to ask for information in regard to the resolution that we have passed, which is to go before the governor. I would ask if the latter part, which was worded with considerable care, is given in the exact way in which it was worded? that is, where we petition that the governor would commute the sentence to imprisonment for life, until such time as this law is repealed. Would it not be better to word it that the governor should take such action as, in his judgment, would be sufficient for the protection of the law, without performing the execution by electricity, by not specifying how he shall do it?

Mr. Morrison: I think the point was raised before.

Mr. Lynch: I think if Mr. Kerr would look in the resolutions, he will find it means that such other persons who may be sentenced during that time also may have their sentences commuted to imprisonment for life until this law has been repealed.

Mr. Morrison: The resolution has abolished for the time being the penalty of death, until this statute can be repealed.

The Chairman then announced that discussion on the papers of Mr. Henthorne and Mr. Perry were in order, and a lengthy and interesting discussion followed, participated in by such practical men as F. H. Ball, W. C. Kerr, C. J. Field, M. D. Law, J. T. Henthorn, and T. C. Smith.

On motion of Mr. Lynch, the Chairman appointed Messrs. Lynch, Smith and Perry a committee to arrange with the manufacturing companies for the adoption of a standard potential for electrical railways.

On motion of Mr. Morrison, a committee of five on nominations for the Executive Committee and on the next meeting place of the Association was appointed as follows: J. F. Morrison, E. T. Lynch, Jr., J. Martin, of Virginia, E. F. Peck and A. J. De Camp. On account of Mr. Peck's absence, the name of Mr. C. A. Brown, of Chicago, was afterwards substituted.

Mr. S. M. Young, of the Julien Electric Company then read a very interesting paper on "The Development and Progress of the Storage Battery."

The Convention then adjourned to 7 P.M., and met at that hour, intending to hold a night session, but as the hall was not lighted, on motion of Mr. Duncan adjourned to 9.30 A. M., Thursday.

THURSDAY'S PROCEEDINGS.

CLOSING SESSION.

President Weeks called the meeting to order promptly at 9.30 and announced the following named gentlemen as the Committee to present the resolution relating to electrical execution to Governor Hill, of New York: E. A. Maher, of Albany, chairman; E. T. Lynch, Jr., New York; Henry C. Davis, New York; J. F. Kelly, New York; C. R. Huntley, Buffalo; F. A. Cheney, Elmira; Chas. Cooper, Brooklyn.

Mr. A. R. Foote, of Cincinnati, then read his report of the Committee on State and Municipal Legislation, which was received and ordered filed. Mr. Foote, on motion, was requested to render a statement of expenses to the Executive Committee.

A letter from Mr. Arthur Steuart, chairman of the Committee on Patent Legislation, stated that the bill desired would soon be put before the Patent Committee of the 51st Congress with every hope of effecting its passage.

Mr. C. C. Haskins, of Chicago, was then invited to the stage and read the following paper, illustrated by means of diagrams:

"DYNAMO ROOM ACCESSORIES OF INTENSITY, POTENTIAL AND RESISTANCE MEASUREMENTS."

The investigator who expects to find a steam plant running without a water and a steam gauge at the present day will reckon without his host, and in very many instances he will find also a tell-tale pressure gauge in the office of the manager, who can turn at any moment, without moving from his desk, and see as well as if he took a run over to the engine room what steam the boiler is carrying. It was not so in the days of Boulton and Watt, but the fact that those worthy representatives of the past were without such modern appliances, has not kept these from becoming honored occupants of the engine room of to-day.

Progress is near akin to that mother of invention, of whom we so often hear, and progress just now calls for more and better appliances for the improvements of our methods of producing, and the handling of that boundless and wonderful energy which we call electricity.

We have advanced far enough to see that economy in production is essential, and we are now learning that having once developed that energy, the old and homely adage of Franklin "Waste not, want not" is as applicable to electric economy as to matters of merchandising, or the cultivation of the soil.

While the inventor is striving, and with reasonable success too, to lessen the fuel expense, and the wear and tear is being looked after by the constructor, we may ask is the operator keeping his end of the burthen level by a proper attention to the means within his reach for aiding in the general economy.

That the inventor has assiduously labored at his part of the task is abundantly shown by the records. There are meters and meters. Ingenious meters, and almost judicious meters. No sooner was it seen that a necessity had arisen for something by which to measure currents, than men of inventive ability and men without, nearly tumbled over each other in their haste to reach the front, and present their various claims. A look at a few of these may not be uninteresting.

I have not endeavored to classify the following, nor do I claim to have gathered all there are in existence. To many of these there are several claimants, and I have quite generally adopted the rule of mentioning no names, a safe method perhaps of keeping out of the muddle which sometimes arises from a trifle of jealousy, and leaving the ownership to be decided by others. My object is to cite the apparatus, not the inventor.

Gravier, in 1880, suggested that with a given carbon, the current consumed would bear a direct ratio to the amount of light given. He supported his statement by mathematical calculations and comparative tests by other methods. This was ampere measuring by photometry.

In the same year, Marcel Deprez, Siemens and Halske brought out nearly parallel inventions. In the former, a long coil is placed parallel too, and between the legs of a horizontal horse shoe magnet, extending from the neutral point to the poles. This coil is so adjusted as to revolve, like a shaft at right angles to its length, being delicately supported at either end. An index attached to the shaft is made to act as a scale beam, and a sliding weight restores it to zero. This form of galvanometric weighing differed principally from Siemens and Halske's invention in that the latter was a vertical arrangement of coil and magnet.

Berquerel and Joule had also accomplished much the same result before then.

Hopkin's voltmetre had two parallel wires, through one of which the current was passed. To one of these an index was attached, the other being part of a graduated arc. The dilitation of the wires by normal heat moving both index and scale in the same direction kept the indicator at zero, so that when a current traversed the second wire there was no error due to normal temperature to be corrected. Heat in this case was the measure of pressure.

Siemens and Halske, among other inventions, exhibited one of a still different form. In this, there is a combination of solenoids and clock work, with a registering disc.

A very radical departure was made by an English inventor, who is well known in electric lighting. In the system which he patented, a lever at one extremity terminated in a solenoid core, while at the other extremity of the lever was a plunger valve. When the current passed through the coils of the solenoid, the core was sucked in, the valve was opened, and water flowed out more or less rapidly in proportion to the size of the opening, which at last of course was governed by the suck of the solenoid, a sort of temperance ampere-meter. An automatic syphon emptied the reservoir and then it filled. The quantity of water was assumed to be directly proportioned to the flow of current. Fig. 1.

In Blythe's ampere-meter, a vertical solenoid has an adjustable core suspended from a spiral spring. A vernier gives the direct reading of from one-tenth of one ampere to 100 amperes.

The Deprez-Carpentier ampere-meter came to the front about this time in the succession. It contains two permanent magnets, bent half way round the inner circumference of a circular box. When nearly at the quarter of each side, the ends are bent inward, parallel with the diameter, and extended parallel with it until they nearly touch. Now we have two magnets, each not wholly unlike the capital letter C, with the open portions facing each other in the middle of the box. In the space left by the magnets, where the four poles so nearly join, is an electro-magnetic coil, which carries the needle and is actuated by the current traversing it. This was a bold step in advance.

Kapp modified Deprez-Carpentier's instrument by making the magnets electro-magnetic, instead of permanent. The scale was graduated experimentally, and the instrument was formed for an ammeter or voltmeter, according to the size of wire used. Here was quite a radical departure. Uppenborn developed a novel idea in the use of an eccentrically shaped armature lying on a simple electro-magnet core, and a pointer fixed to the same axis as the armature. The pointer stands at one end of the curved scale when at zero. As the current increases, the eccentric face of the rolling armature gives to the pointer a movement along the scale, and a direct reading may be had. This graduation is arbitrary—done by a sort of cut and try method, or thumb rule. The improved voltmeter of this form has two coils instead of one, the greater to extend its sphere of usefulness. A switch gives choice of the coils.

A French invention is dependent for its results upon the action of solenoid attraction upon a movable core, the depth of this plunge being compensated by a weight which slides on a steelyard arm attached to the pointer—a method of weighing the current.

Deprez, according to Niadet, conceived the idea of valuing current by weighing it by the aid of a solenoid coil. The scale of proportions was arrived at by actual experiment. A certain known current balanced a given weight. A second current would balance a greater or less weight, according to its quantity, and thus he was enabled to say "with a magnet of such and such proportions I find that a current which weighs blank grammes is a current of 10 amperes."

A well-known inventor has endeavored to utilize the heat generated by a current to turn a horizontal wheel, against the diagonal paddles of which the rising air impinges. In another form there are two upright solenoids and two cores. These cores are fixed to and are a part of a rectangular frame which moves on two centers at the middle of the top and bottom bars of the frame. At two diagonally opposite corners the cores are placed, and the winding of the coils is such that when one core is sucked up into one coil, the other is drawn downward into the other coil. This see-saw motion is communicated to the pointer from its being fastened to the frame at the upper center of motion. A counterweight tends to hold the pointer at zero when in a state of rest. Fig. 2.

There are forms in which the needle is loaded with small magnets, and the poles of electro magnets are so placed as to double the magnetic action of these on the balanced needle.

The molecular structure of glass is so affected by magnetism as to change the direction of a beam of light transmitted through it, and this property has been taken advantage of to measure currents of electricity by the deflection of a ray of light. In one of that form of voltmeter, which measures current by the expansion of a wire through the heat generated by the passage of a current some improvement has been made.

In this a wire of platinum silver is inclosed in a brass tube held in tension by springs or weights. Formerly the absolute tension of the wire did not give exact results if the wire was exposed to changes of atmospheric temperature. Even when not in use the zero of the instrument is changeable. In the more recent instrument the brass tube surrounding the wire is made to have the same coefficient of dilatation as the wire itself, so that by compensation the zero remains very nearly absolute. The outer air has no longer any power to change and falsify the record of the instrument.

Another form of voltmeter in which the dilatation of a wire is utilized to measure current pressure is a modification of the last. There were unforseen difficulties in the way of accuracy. The increased length of the wire was assumed to be solely due to heat expansion, but investigation showed that with that expansion there must be considered the change in stress consequent upon the elongation, and the accompanying increased sag. A remedy very similar to the former remedy was applied, and the work is now sufficiently correct for all practical purposes.

Measurement of the gases developed by the electrolysis of acidulated water was one of the first, as well as simplest of apparatus. Secondarily, the heat so generated has been made to do duty as a meter.

An ingenious German inventor endeavored to utilize the heating effect of current by the aid of a double thermometer, the two branches connected with a thermopile in a way to increase the temperature in one branch and reduce it in the other, through the Peltier effect, when current is sent through the thermopile.

Walker, in 1885, and Wolf, 1886, also utilized the electrolysis of acidulated water with platinum electrodes.

A Russian electrician measured the time necessary for the solution of one cubic centimeter of hydrogen by a given number of amperes of current. From this, as a starting point, he has formed a table showing the time necessary to disengage one unit of gas with one unit of current at temperatures varying from 15° to 24° Centigrade.

A German was among the first to discard springs and permanent magnets in amperemeters and voltmeters. His instruments were galvanometers, with regulating pieces of soft iron for adjusting the index pointer.

An English firm followed about the same time with a novel idea in ammeters, in which the compound action of magnet upon magnet was utilized.

To escape the use of springs and permanent magnets, a French inventor produced an instrument in which a plate of soft iron is affected by opposing magnetic influences, being both repelled and attracted. The use of this instrument requires either a mathematical education, by means of which to calculate the result, or some other instrument of a simpler character to verify the work. The use of this form of meter is not unlike reading fiction to learn history. If the reader knows the history beforehand he does not need the fiction. If not, it may be somewhat difficult to separate the true from the false.

Simplicity is made simpler in another form where the inventor uses an electro-magnet with a multiplicity of armatures, each held back by its own retaining spring. The more current you use for bait, the more armatures you will catch. All you need to do is to count them.

A novel form had its origin in Berlin. In this, the pivot of the index needle lies within the solenoid, and one or more short fine wires are attached to this centre, at about right angles to the needle. The magnetic action tends to set these, which are, in fact, one armature, at right angles to the current, and as a consequence, the indicator is moved along the scale.

The weak point in this, and many other clever instruments lies in the fact that magnetic action is not proportional to the angle of deflection, but to the tangent of that angle.

An Austrian inventor places the needle between two contact screws, and any deviation from normal voltage closes the circuit through one or the other of the two coils, having differently toned bells, so that the employés are warned not only that the pressure is changed from normal, but whether it is above or below that point.

An European device, in quite extensive use on the continent, has two clocks, with pendulums so adjusted as that in their normal condition their motions are perfectly synchronous, though independent of each other. One of these pendulums terminates in a fork, which holds a spool of fine wire, and this last is free from and swings back and forth in a coil of coarser wire, like a core in a solenoid coil. The main current energises the larger, or stationary coil, while the movable coil of fine wire is in a derived circuit from the main line. The mutual action of the magnetism in the two coils, of course, varies the pendulum motion, and a set of clock face counters—similar to those on a gas meter—registers the amount of current.

The heat developed by resistance offered

to the passage of a current, has been utilized to vaporize a liquid and produce motion in an ingenious manner. A horizontal lever has dependent from either extremity a closed bulb, containing a fluid. The two bulbs are connectedand in their normal condition are balanced. Within the fluid a coil is placed, its terminals extending down through the bottom. When either bulb is depressed these terminals dip in mercury cups and complete the circuit. Heat is generated in the coil, the liquid is vaporized, and the vapor makes its way over to the other bulb, where it is condensed. By and by the balance is destroyed and the beam tips, breaking the circuit on one side and making contact on the other. The operation is repeated alternately from either direction, and every time it makes one complete vibration,

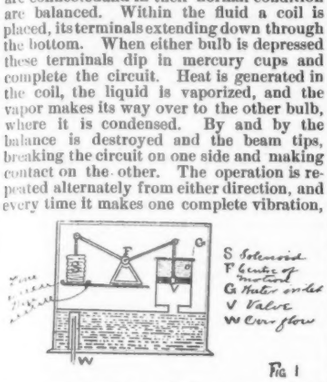


Fig 1

a ratchet wheel is pushed one notch ahead by a dog attached to the tilting lever. Fig. 3.

To obtain a permanent record of the meter's work, a well known French maker of instruments of precision added a revolving drum of paper, on which a pencil attached to the index lever traces the variations of voltage.

A very clever method of getting the pressure of a high voltage system by means of a low voltage instrument has been used with fair success by the aid of high resistance incandescent lamps. A sufficient number of these, arranged in series, are placed in a derived circuit around the motor dynamo or lamp. When the proper number of these is introduced in the circuit to bring their candle power up to proper brilliancy, the lamp resistances are measured separately, and the aggregate is comparatively the difference of potential between the terminals. A good approximate system where no better can be obtained. Fig. 4.

Of electrotylic meters, there have been many. One of novel construction is an American invention. In this apparatus, the entire line current is passed through a solution of caustic potash. The gas evolved, after being forced through water to clear it of froth or other impurities, passes into a meter similar to that used for gas measurements, whence, after having moved the dial it is permitted to escape into the open air.

In this class of meters there are probably none better known than those in use by the Edison system throughout this country and Europe. Their action is based on the elec-

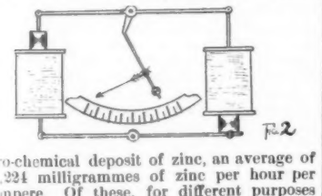


Fig 2

tro-chemical deposit of zinc, an average of 1.224 milligrammes of zinc per hour per ampere. Of these, for different purposes connected with that system, several have been brought out. A very ingenious one, with which you are all familiar, has the lamp attachment by which a safe temperature is insured to the meter.

The Wheatstone bridge principle is used in one form of pressure indicator for constant potential plants. The circuit to be measured includes a lamp through which the current flows. The amount of current passing is determined by its voltage, and the resistance of the filament is measured by the heat developed. The scale is so graduated that at any time when the needle of the galvanometer is brought to zero, thus balancing the bridge, the index pointer gives a direct reading of the current pressure.

Another modification of the bridge principle is used for constant potential current measurements. In this form one or two standard cells are placed in derived circuit around a variable resistance. The battery is opposed to the current under examination. When by sliding the contact along the scale the needle is brought to zero, the pointer indicated the voltage sought.

When the question is of meters for alternating currents the problem is much more complicated, but the inventors, nothing daunted, have, since the comparatively recent introduction of these systems, done an immense amount of attempting with some success. Many of these are of such recent birth that patents have not yet been secured, and inventors are somewhat reticent about having their little ones paraded before the electrical public too early, for reasons of their own.

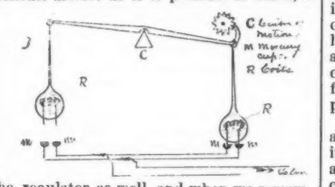
Siemens' electro-dynamometer was one of the earliest instruments for measuring the potential of an alternate current. In this, the inventor availed himself of the mutual reaction between two coils, one within the other. The inner coil is connected to the circuit on one side through the torsion spring which holds it in suspension, while the other terminal rests in a mercury contact. This arrangement permits of a rotary motion without breaking the connection. The deflected coil is brought back to zero until it will no longer deflect. The pointer gives a reading which is proportional to the square of the current.

It will be readily seen that no matter how often or how slowly the alternations take place, the result must be the same, for no sooner does the direction change in one coil, than the other is similarly affected.

Another form of induction instrument is described in a German technical journal. In this there are no less than four coils, two main and two secondary. A Wheatstone bridge figures in the combination, and plays an important part in the apparatus which is too complicated in its detail for any but an extensively illustrated explanation.

As early as 1884, the current itself was made to do duty in energizing an electro-magnet, as up to that date permanent magnets were unsatisfactory; but Weston's new instrument, in which a permanent magnet is used, I have seen tested with very rough usage without perceptible change. The method of magnetism I believe is known only to the manufacturers.

Objection has been made to the use of springs in measuring instruments, because of an assumed liability to change in form or elasticity. This assumption seems to me fallacious when we consider the reliability of delicate mechanism like time-keeping machinery, in which a spring not only furnishes the motive power, but a spring as delicate almost as it is possible to make, is



the regulator as well, and when we remember the permanent molecular changes which might be expected to arise from the rapid doing and undoing of the delicate hair-spring, or the heavy and powerful daily movement of the driving spring.

Many more systems might be mentioned. Indeed, one hardly knows where to stop, for every weekly report from Washington adds to the list of instruments for the measurement of either pressure, or quantity of work, or something. Many that I have mentioned are out of place, save in the laboratory, while as to the correctness of the results obtained, electrical doctors disagree to an alarming extent. As a result, the majority of ampere-meters in industrial use are to-day known as ammeters, and for simplicity of structure are little more than a stick and a string. A hollow coil, which is the arc of a circle, the center of which is the center of motion of a radial arm terminating in a wire core, with an index arm attached, which in a state of rest stands at zero. A solenoid, with a direct reading scale—that is all. If correct, it is all that is necessary—but who knows.

Of the more complicated apparatus, much may be said as to its accuracy of action. Those in which permanent magnetism is used have not hitherto retained the magnetic constants, and it is a mooted point between certain French and English electricians whether there is any method by which an accurate measurement of an alternate current can be made by any known process. In a discussion of this nature, I can see perfectly well a little way back, and do not purpose venturing an opinion.

The change in the magnetic power of a horse shoe has sometimes been attributed to the careless method of removing and replac-

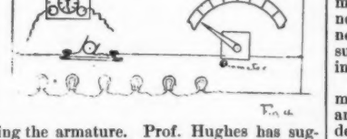


Fig 4

ing the armature. Prof. Hughes has suggested that the only constant magnet is one which, after thorough saturation, is hammered until all possible of its magnetism is driven out of it. The small residuum is permanent, and not likely to change.

Dr. Hopkins, with other lesser lights, has repeatedly found that the employment of an astatic needle is imperative in the neighborhood of magnets and magnetic fields.

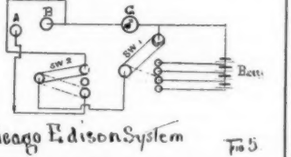
The use of an iron casing does not thoroughly obviate the difficulty. The necessity for a constant is a serious drawback to the ordinary user, even should the calibration of the instrument remain unchanged. The use of battery by which to energize an electro-magnet introduces another serious inconvenience. A standard battery is not at all times readily attainable—is not inexpensive and may possibly be unreliable.

In galvanometer work with a portable battery of standard cells, I have noted a marked difference in deflection through standard resistances, which I could not explain. The importance of convenient and constant, as well as simple apparatus for the measurement of current flow, as well as potential, is of easy comprehension. It may be summed up in a single sentence, which might appropriately be framed and hung in the dynamo room, as a hint to the engineer and the dynamo tender. "It takes money to buy coal."

Excess of pressure in a constant potential system means, as an electric light man once tersely remarked to me. "coal wasted, filaments busted, patrons disgusted." There is always a triangular duel between the patron, the company and the coal pile on the subject of amperes, volts, candles and lamps and dollars. Now and again the wire men too are drawn into a wrangle on the subject of insulation, or the armature complains in a very feeling way that it has been abused needlessly. Thus, from every standpoint, the necessity of keeping a safeguard over undue waste is a vital question with the electric light men.

Hand in hand with apparatus for measuring current flow and current pressures should go instruments of precision for the daily measurement of line insulation and copper resistance. I use the sentence "instruments of precision" advisedly, as the only known apparatus in many localities, and in far too many stations, is as distant from being an instrument of precision as a bell-hanger is from being an electric wire-man. As you are probably aware, this conviction is not a recent one with me. If there is any one thing in the whole business of electric lighting for which I have the most thorough and uncompromising dislike for testing circuits, it is the magneto bell. I wish I could feel that all my hearers were in full sympathy with this sentiment.

The objections to the ordinary magneto are many and positive. In the first place, it is an alternate generator, and will ring on a perfectly insulated line of sufficient static capacity, as readily as with a dead ground. There is positively no way of determining how much insulation resistance there is in the line. It will ring or it will not, and that is all you ever know. There is no degree of measurement. With one person who grinds it there will be a ring, while a less vigorous employé will fail to make any impression upon it. It becomes in the hands of linemen who are encouraged to use it a scape goat for neglect, for laziness and a loss to the owner of the plant. It has not the range required for proper insulation of an arc line,



Chicago Edison System

Fig 5

nor even for a 50-light incandescent plant. The range of the ordinary magneto is less than 15,000 ohms.

With a tangent galvanometer, the measurements may be made by a little exercise of pencil and paper, and the aid of a table of tangents. The intensity of the current, as measured by the tangent galvanometer, is proportioned to the tangent of the angle of deflection of the needle. We will first obtain a constant by the measurement of a known resistance—say 10,000 ohms. Any other known resistance would be as well. We note the deflection, and turning to a table of tangents note the tangent of 30°.

We next connect one pole of our battery to earth, and the other terminal to the galvanometer, which latter is connected to the line. All detectors and other earth attachments having been removed, the whole is now a metallic circuit. Closing the key we note the deflection in degrees of our line insulation, and find the tangent of that figure in the table.

Now, the tangent of the first deflection, multiplied by the known resistance, 10,000, and divided by the tangent of the second deflection, will give us the number of ohms of line insulation resistance. Or, its tangent is to the deflection through the known resistance as the tangent of the second deflection inversely is to the unknown resistance. A very convenient little combination has been much used in Chicago, which answers an excellent purpose in construction work and testing, where all that is necessary is to reach a maximum insulation. In a small box, a battery is placed with a switch for connecting with a galvanometer through a standard resistance coil, or to line. Two binding screws receive the line connection and the earth wire. Having placed the galvanometer needle in the magnetic meridian, the switch is turned, throwing the current through the known resistance. Note the deflection. Then switch to line. If the galvanometer needle deflects less than before, the insulation has more ohms resistance than the standard coil.

A switch enables the operator to use any number of cells from one to the full number, so that within a somewhat limited range, considerable accuracy may be attained. (Fig. 5).

Every now and then the suggestion is made to place a permanent ground on an arc line, in order to know when a second ground occurs. The use of a safety fuse comes in at once as a natural sequence. The suggestion is fraught with great danger to both life and property, and takes no heed of the time it requires a good healthy current to "get there." While it is true that the first ground does no harm *per se*, it must be remembered that without a first ground a second ground is an impossibility, and the second ground is the troublesome one. There is a fascination about rigging up some sort of an arrangement for telling when there is trouble, rather than to keep the trouble at bay on general principles. An acquaintance brought to me one day, with his face all aglow, a sketch of a piece of clockwork, ingeniously arranged to make an instantaneous contact to ground once an hour while the plant was running. This ground contact had, between the line and ground, a safety devise which held up a key to a second circuit, that could only close when the fuse melted. On this second circuit he had a battery and a bell located so that everyone in the room must hear it, and continue to hear it until it was switched out or the battery ran down. It never worked, for I convinced him of its impracticability by asking him to form the second ground through his body as an experimental test.

Testing sets are made by various firms, which do excellently well for all species of measuring which may be necessary about the station or on the line. The combination includes a Wheatstone bridge with a normal capacity up to over a megohm, and down to fractions of an ohm. With an additional box containing extra coils, and a split plug and cord attachment, this capacity may be carried to twice or three times its ordinary capacity. A battery and galvanometer finishes the set, which is made up in two portable cases.

No electric light station or plant of any consequence should be without some such means of electrical measurement, and no dynamo should be run without a daily test of insulation and a test of copper resistance.

A bad joint may cost many pounds of coal, but a ground leak may be far more expensive in many ways, while both may be prevented by the proper constant use of a set of testing instruments. A daily record should be kept of these tests, together with condition of the weather, etc.

I have read somewhere of a ladder which was seen in a dream, the three principal rounds of which are faith, hope and charity, the greatest of these being charity. We have in the electrical ladder three principal rounds also. They are current, potential and insulation.

Mr. Benjamin Rhodes then presented his paper on

"THE ECONOMICAL SIZE OF LINE WIRE FOR CONSTANT CURRENT CIRCUITS,"

as follows:

The writer has for some time been accustomed to use a formula for finding the economical size of line wire for constant current circuits and has been requested to present it at this time. With the knowledge that it is not new, and yet that it is needed by many practical electricians, the following is submitted:

Let X=diameter of line wire in mile.
" A=length of circuit in miles.
" B=price of copper per pound.
" C=cost of power per year per h. p.
" E=amperes of current.

When any plant is about to be established, B and E are known, C can be determined near enough for our purpose, and A will be found to be immaterial.

.016 X^2=pounds of wire per mile.
.016 B X^2=cost per mile of wire.
.0016 B X^2=interest and depreciation at 10 per cent.
.0016 A B X^2=annual cost of wire. (1)

$\frac{54577}{X^2}$=ohms per mile.

$\frac{54577\ E^2}{X^2}$=watts per mile.

$\frac{54577\ E^2}{746\ X^2}$=horse-power lost in transmission per mile.

$\frac{54577\ C\ E^2}{746\ X^2}$=cost of same.

$\frac{54577\ A\ C\ E^2}{746\ X^2}$=annual cost of power lost in entire circuit. (2)

It is plain that with any increase in the size of wire the value of (1) will increase while (2) will diminish, and the economical value of X will be such that the sum of (1) and (2) will be a minimum.

Let u = this sum.

$$u = .0016\ A\ B\ X^2 \quad X \quad \frac{54577\ A\ C\ E^2}{746\ X^2}$$

Differentiating.

$$\frac{du}{dx} = .0032\ B\ X - \frac{109154\ E^2\ C}{746\ X^3}$$

Placing this equal to zero, and reducing, we have:

$$X^4 = \frac{45700\ E^2\ C}{B}$$

This formula shows that diameter of wire depends on price of copper, cost of power, and quantity of current, and is entirely independent of the length of circuit and voltage.

The differential co-efficient shows that the formula is in harmony with Sir William Thomson's rule that "the additional running expense due to the resistance of the conductor shall equal the interest on its first cost."

Price of copper refers to the bare wire without any covering or insulation whatever. The insulating cover is a mere matter of choice, like a brick, stone or frame station.

A few examples are added for illustration, the price of copper assumed at 20 cents per pound for facility of calculation.

What size wire should be used in a transmission of power plant using a 40 ampere current, power costing $100 per year per horse-power?

Here E = 40, C = 100, B = 20 substituting X = 427 mils or nearly 0000 wire B. & S. guage.

If the power cost 50 dollars per year then C = 50 and X = 359 or 00 B. & S. With water power at $10 per year, X = 240 or between 2 and 3 B. & S.

Should a 20 ampere current be used in the three cases above, the results would be respectively:

X = 302 larger than 1 B. & S.
X = 250 2 B. & S.
X = 170 between 5 and 6 B. & S.

What size wire is economical in an ordinary city arc light ten ampere circuit steam power costing $50 per year.

E = 10 C = 50 B = 20

Giving X = 180 or No. 5 B. & S.

Suppose water-power can be furnished at Niagara Falls for $10 per horse-power per year and a 10 ampere current generated by this power be used for street lighting in Buffalo, the entire length of circuit being 50 miles, what is the economical size of line wire?

A substitution in our formula gives X = 120 mils equal to No. 8 wire B. & S. or exactly No. 11 Birmingham wire gauge.

Dr. Otto A. Moses, chairman of the committee, reported the following new constitution, which was accepted as it appears below:

NEW CONSTITUTION AND BY-LAWS.

ARTICLE I.—*Name.*

This Association shall be entitled THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

ARTICLE II.—*Object.*

The object of this Association shall be to foster and protect the interests of those engaged in the commercial production of electricity for conversion into light, heat and power; and of manufacturers of apparatus and supplies used in these industries.

ARTICLE III.—*Members.*

SECTION 1.—Members shall be divided into three classes: Active, Associate and Honorary, of which the first only shall be entitled to vote.

SEC. 2.—Active members shall be: corporations or individuals engaged in the business of producing and supplying electricity for light, heat or power, for commercial or public use; and the members of the Executive Committee.

SEC. 3.—Associate members shall be Electricians, Electrical or Mechanical Engineers, Manufacturers, and individuals who are otherwise directly or indirectly interested in advancing the uses of electricity.

SEC. 4.—Honorary members of the Association may be elected upon the unanimous recommendation of the Executive Committee and approval by a two-thirds vote of the Association.

ARTICLE IV.—*Officers.*

SEC. 1.—The officers of the Association shall be a President, two Vice-Presidents, a Treasurer and a Secretary, and an Executive Committee, to consist of the above-named officers, *ex-officio*, and nine other members, of whom three shall be selected from among the Associate Members.

SEC. 2.—The President and Vice-Presidents shall be elected by ballot, to serve from the close of the annual meeting at which they are elected until the close of the next annual meeting.

SEC. 3.—No person shall be eligible for the office of President or Vice-President for more than two successive terms; but this shall not be construed to forbid the election to the office of President of one who has served as Vice-President.

SEC. 4.—The Secretary and Treasurer, who may be one and the same person, shall be nominated by the President, subject to confirmation by the Executive Committee. The salary of the Secretary shall be fixed by the Executive Committee; and he shall have an office in the city of New York.

SEC. 5.—The Executive Committee shall be chosen by ballot at each meeting, either annual, or semi-annual or special, and shall hold office from the close of the meeting at which its members are elected until the end of the meeting at which their successors are chosen.

SEC. 6.—The Treasurer, Secretary and Executive Committee shall make written reports at each meeting, which reports, upon their acceptance, shall be spread upon the records of the Association.

SEC. 7.—The Executive Committee shall be the governing body of the Association. It shall meet at the call of its Chairman, from time to time, and shall report upon applications for membership, shall gather and prepare information upon topics of interest, and shall arrange for discussions at the several meetings of the Association. Five members of the Committee shall constitute a quorum.

ARTICLE V.—*Meetings.*

The Annual Meeting of this Association shall be held in February, and a Semi-Annual Meeting may be held in August of each year, at such places as the Association shall determine, and on such dates as may be determined by the Executive Committee.

ARTICLE VI.—*Dues.*

THE ANNUAL DUES SHALL BE $30, PAYABLE IN ADVANCE, AND SHALL COVER THE CALENDAR YEAR.

ARTICLE VII.—*Ballot.*

A ballot may be demanded by ten of the members present on any question before the Association.

ARTICLE VIII.—*Amendments.*

SECTION 1.—Amendments to the Constitution shall be presented in writing and shall be referred to a committee, to be appointed by the Chairman, before being acted upon by the Association; a two-thirds vote of those present shall be necessary to their adoption.

SEC. 2.—No amendment shall be voted upon on the day of its first presentation.

Mr. C. A. Brown: I move that the report of the Committee on the Revision of the Constitution be accepted. Seconded by Mr. De Camp.

Mr. Lynch: I would suggest that, as this proposed constitution is very important, we take it up *seriatim* and discuss it, article by article, and pass upon it so. One or two little changes I would like to suggest, and I think that would be the most satisfactory to all.

Mr. Morrison: The motion is not in order. You accept the report, and then discuss its provisions.

On motion, duly seconded, the report was accepted.

Mr. Brown: Mr. Chairman, the report of the Committee on the Revision of the Constitution having been accepted I would now move you that a committee of five be appointed by the president for the formulation of by-laws or rules of order for the Association.

Mr. Phelps: I second that motion.

Mr. Whipple: Do I understand that this constitution has been adopted?

Mr. President: Accepted.

Mr. Whipple: What do you mean by accepted?

The President: That it is now the constitution of the Association.

Mr. Whipple: There is a difference of opinion here as to whether this matter is before the Convention, or whether it has been adopted.

The President: The ruling of the Chair is that it is now the constitution of the Association. The word used by Mr. Brown was accepted.

Mr. Whipple: Does that adopt the report—the acceptance of the report does not, as I understand it, adopt it. If the report had been adopted that would be right, but it was accepted and was open for discussion.

Mr. Lynch: My motion was made with the understanding that the report was to be received. I do not think we should quibble as to whether it is adopted or received. Some of the members want to talk on the changes meditated in the constitution.

The President: The discussion is out of order. All discussion to this point must be on Mr. Brown's motion for the appointment of a committee of five on by-laws.

Mr. Morrison: Mr. President, I move as a substitute, that the Executive Committee be instructed to prepare by-laws.

Mr. Brown: I accept that amendment.

This motion, being duly seconded, was carried.

Mr. Whipple: I move that the motion of Mr. Brown to accept the report be reconsidered.

Mr. Brown: Mr. President, I would like to ask how the gentleman voted on that question?

Mr. Whipple: The gentleman did not vote at all.

Mr. Brown: I rise to a point of order, that, as he did not vote upon the question, he cannot call for reconsideration.

The President: Mr. Brown's point is well taken. We will now hear from Mr. G. W. Mansfield, of Boston.

Mr. Lynch: I think I voted on that subject, although my voice was very low. (Laughter.)

The President: The Chair rules that Mr. Mansfield has the floor.

"ELECTRIC RAILWAYS," BY GEO. W. MANSFIELD.

The application of electricity to street railways has been so rapid that we are liable to lose sight of many valuable points in our herculean efforts to supply the demand. Those who are engaged in it know that they let many opportunities slip by. They cannot help it. The more generally, however, the points are known the quicker will be the reward to some directly, and to them indirectly.

The application of electricity during the past decade have been astonishing. In the face of an industry a half century old, and of enormous wealth and power, it has won the leading position. In every direction that honest effort has been made, it has succeeded. Commercial barriers have been broken down and physical obstacles swept aside. When once the feasibility was demonstrated the end could not be predicted.

For the transportation of the people in the streets of our towns and cities the demonstration has been witnessed, the application made and a wonderful luxurient growth started. There is no industry so far reaching in character, so vital to a community's interests, and yet one so little known as the street railroad business. Neither the scientific world, the commercial world, nor the people themselves have realized its vast importance. Eleminate the horse car from every city or town in the Union and forecast the results.

In 1828 the now great Baltimore and Ohio Railroad started and horses were used to draw the cars. This might be called the first horse car line in the United States. In 1830 there were 12,866,020 persons in the United States, and not a mile of street railroad nor scarcely of steam road. As a rule the New York and Harlem Railroad, incorporated in 1831, is spoken of as the first street railroad in the country. The first car was run in November, 1832, from Prince street to Harlem Bridge. In 1837 it temporarily succumbed to steam cars, but resumed in 1845.

The census of 1850 gives our country a population of 23,191,876, and published history but one street railroad. The child had been born, however, and in ten years the street railroad was in almost every city of any magnitude in the country. To what has this child grown? In 1880 our population was 50,155,783. Estimating on an increase of 33⅓ per cent. in 1890, or six months hence, the population will be 66,874,354. For the transportation of this number of people in the streets of our cities and towns the most accurate figures it is possible to obtain show the engagement of about 425 companies employing 28,000 cars, 125,000 horses, and operating some 3,500 miles of track. The capital invested is variously estimated from $175,000,000 to $200,000,000.

The number of passengers carried is so enormous that it is impossible to obtain figures of any great degree of accuracy. As a result of most careful compliations and estimations it is reasonably sure that at least 1,500,000 passengers are transported.

Still more striking is the importance of the street railroad business when compared with the magnitude and extent of the steam railroads of the United States. The figures of 1887 show a tabulation of 147,998.60 miles of railroad and 20,582 passenger cars, and passengers carried but 428,225,513. With nearly an equal number of cars and 42 times more road, only ¼ as many passengers were carried. Behold the yet more amazing figures: The horse cars of the City of New York carry 199,491,735 passengers, almost half as many as are carried by all the steam roads in the United States. If to this number are added those carried by the elevated roads we have the total of 371,021,524, or almost as many passengers are carried in New York City alone as are annually carried by all the steam roads in the whole United States. The street railroads of the State of Massachusetts carry over 44,000,000 more people than all the steam roads in that State One road alone, the West End of Boston, carry nearly 10,000,000 more than all the steam roads combined.

To show somewhat in detail where this tremendous traffic is, I have prepared Table I. Most of the figures showing passengers carried were obtained from reliable sources, and the balance were estimated from an average obtained from those I was sure in regard to.

If you figure for each car six horse-power of electric energy it will give you a rough idea of the size of an electric central station needed to operate all the cars. In New York City dynamo capacity of 13,800 h. p. would be demanded, in Boston 9,504 h. p., and so on. This is destined to come as surely as the days succeed each other. In Boston it has come, and a station of approximately 8,000 h. p. is already in the hands of the engineers.

If the conservatism of Boston permits it, how can the result be but inevitable for the other great cities of the Union. This enlightened age will have these facilities for transportation, and as soon as it is possible and wise. The universal cry to-day in almost every large city the length and breadth of the land is for cleaner, surer and more rapid transit.

Unfortunately the tendency of the times is to concentrate in or around large cities. This means congestion with all its deplorable results. The solution lies to a very large extent in the street railways. These must be the cities arteries and veins extending from the heart in all directions to its extremities. Improve then the street railways. Almost every method of applying energy to street cars has been applied and they all have finally "bitten the dust" in the great battle for life.

The Baldwin Locomotive Works have for years been engaged in the manufacture of steam dummies for street railways.

Unquestionably through them the highest order of talent and skill has been lavished upon the solving of the vexed problem, as to how to use steam for the haulage of street cars. Motors weighing from 13,000 to 27,000 lbs. when in working order and ready to run have been built. In most cases two engines have been employed with cylinders and strokes ranging from 8" x 10" to 12" x 16". The power of these engines can be judged from their pulling capacity which varies from 320 tons to 634 tons on a level, and from 16 to 43 tons on a four per cent. grade. Ordinarily they were built to seat from 15 to 20 people.

The wheel base was generally six feet and the wheels 31" in diameter. Naturally they were built to run at speeds from 10 to 15 miles per hour, and to be provided with all possible safe guards and conveniences.

Powerful brakes were used, coke was burned to avoid smoke, mufflers provided for the exhaust and safety valves, and every other possible contrivance adopted to eliminate all objectionable troubles. Their economy in working has not been very freely published. From reliable and authentic sources we learn that the lowest fuel consumption is 6½ lbs. of coke per mile

TABLE I.

CITIES OF 1,000,000 POPULATION AND OVER.

Name.	Companies. Elevated.	Companies. Horse.	Miles Single Track.	Total Track-age.	No. of Cars.	No. of Horses.	Locomotives.	Total Passengers Carried.
New York	2	19	60 143	89 268	948 2,800	14,441	291	171,529,789 199,491,735
Brooklyn	3 Miles Cable included. 3	14	135 24	207 35	2,335 247	8,410	91	105,975,249 18,632,082
Boston	1	211	231	1,534	7,684			97,039,919
Providence	1	54	289	1,414				15,582,732
Chicago	44 Lines in 1 System.	7	325	325	2,400	8,279		99,348,000
Philadelphia	12	302	326	1,512	7,322	8 Dummies.		143,433,959
St. Louis	3 Cable.	14	169	169	1,068	4,231		50,772,000
Baltimore	12	158	158	460	3,167			34,837,000
Cincinnati	2 Cable.	30 Lines 7	164	164	530	2,644	4 Dummies.	31,728,000
New Orleans		7	140	140	499	2,019	18 Dum's. 7 Loco.	24,228,000
San Francisco	2 Steam. 8 Cable.	10	163	164	707	1,734	3 Loco. 39 Dum's.	130,860,000
Buffalo		2	39	56	198	1,276		13,108,203
Washington		5	63	63	336	1,684		21,892,000
Newark		3	53	53	219	1,364		15,168,000
Louisville		2	112	112	378	Mules 2,270 Horses.		24,970,000
Cleveland		7	123	123	523	2,521		30,252,000
Pittsburgh	6 Cable, 1 elec.	13	113	113	347	1,924	3 Dummies.	29,088,000
Jersey City		2	35	35	132	825		10,725,000
Detroit	3 Elec.	4	65	65	263	1,682		32,184,000
Milwaukee		3	68	68	206	1,188	2 Loco.	16,744,000
Albany		3	19	30	108	434		4,278,927
Indianapolis	Consol'd.	1	40	40	99	648		9,720,000
Kansas City	6 Cable.	7	124	124	469	613	38 Dummies and motors.	33,969,000
St. Paul	1 Cable.	1	74	74	154	816		22,608,000
Omaha	2 Cable, 3 elec.	1	61	61	167	880	24 Motors.	30,540,000
Minneapolis	Con'd.	1	66	66	160	1,104		14,392,000
Totals		189	3,103	3,414	18,645	77,884		1,434,057,595

Five elevated roads, 27 cable, 147 horse, 7 electric, 3 steam and horse combined—189, total; 18,645 cars, 594 locomotives, 154 dummies and motors; 77,884 horses, 2,270 mules—80,154. About 24,000 horses are annually disabled.

run. The average is from 10 to 12 lbs. when ordinary grades are ascended. The total cost of operating per mile has been in some instances reported to be put 3½ cents, but in other cases it was found to be over 20 cents per car mile. It is needless to say that in spite of all the skill, time and money spent upon them, they have not proven, except in a few isolated cases, either satisfactory or economical.

Electricity, the youngest of them all in application, shows already the sturdy, vigorous growth that inevitably will result in its complete supremacy.

TABLE II.

ELECTRIC STREET RAILROADS.

	1885.	1886.	1887.	1888.	Jan. 1-July 1, 1889. Oper. after.	Jan. 1-July 1, 1889. Build-ing.	Jan. 1-July 1, 1889. Total.	Total.
No. of Electric Railways.	3	5	7	33	19	42	61	109
No. of miles of road	7.5	28	29	130.5	113	267	380	575
No. of cars	13	39	81	265	174	364	538	936

The figures of Table II certainly show that the facts warrant the prediction. They were most carefully prepared and include every road of any record. It does not show it all either. That remarkable contract which the West End Street Railway Company, of Boston, the largest street railway company in the world, signed recently with the Thomson-Houston Electric Company is not included under the heading "roads building in 1889."

I think that this contract in responsibility and importance is one of the greatest that has ever been signed in the history of electricity. In electric railroading it is the greatest and probably will be for many years to come.

The West End Street Railway Company, of Boston, owns 217 miles of track and 1,584 cars, all of which are to be equipped so as to be operated with electricity. Add these to the list, and how does our list stand? If it be within the bounds of the supply men, at least 75 miles will be built this summer and 100 or more cars equipped. Will not this give the electric railroad industry a standing warranting the attention of the whole railroad world?

As an interesting comparison regarding the new industry, if I may call it such, note the following figures:

	1870.	1880.	1890.
Total H. P., both water and steam, engaged in the whole manfg. industry of the U.S.	2,346,142	5,410,837	Estimated. 5,255,582
Total H.P. engaged in the electric lighting and power industry..	0	1,000	500,000
Total H.P. engaged in electric railway industry....	0	0	30,000

In meeting this demand of the age for better transit there are many considerations that claim our most careful attention.

The conditions to be met are widely different from all other electrical applications. Essentially we have first a steam engine; second, a dynamo; third, a conductor; and fourth, a motor mounted upon a vehicle; and subjected to mechanical and physical conditions more extreme and severe than ever heretofore has been imposed upon any piece of electrical machinery. In the battle for success the engine has to stand the bulk of the fighting. Anything wrong with it affects directly the electric system, and in many cases it also has to stand the blows if anything is wrong with the electrical system. Dr. Bell has pointedly shown in his valuable paper many well-known facts, and clinched them by figures taken on one particular road. They can be taken with certain allowances as fairly representing the conditions imposed upon the steam engine by an electric road.

The extreme liability of short circuits on the road from falling wires, careless drivers turning the current on too suddenly when starting, and a variety of accidents that may happen on the very best roads render of the first importance that the engine have its main moving parts at least 20 per cent. heavier than ordinarily. Under the extreme fluctuations of load, keys, nuts and bolts will work loose. An engineer in a large station recently told me that he practically took to pieces and put together nearly every month a 100 horse-power engine running an 80 horse-power dynamo, whereas prior to the time it had been connected to a railway dynamo it had given practically no trouble although worked well to its capacity.

Hanscom, of cable railroading fame, writes: "We do not consider it good engineering to design an engine to suit the general average of all lines in the country." He argues special engines for every road. Mr. C. B. Holmes, president of the Chicago Cable Company, writes: "I would recommend that the strength of parts and weight of fly wheel be at least one-third greater than the usual run of engine power." Our business is analogous, and I think we should heed their counsel.

A compound engine rated at 109 horse-power, running an 80 horse-power dynamo under test recently, gave the following:

Friction card with dynamo but no current, 11.65 horse-power.

Aggregate horse-power of cards, 1,247.74 horse-power.

Average horse-power of cards, 56.67 horse-power.

Maximum card, 130.79 horse-power.

Minimum card, 15.56 horse-power.

The cards were taken at 10 minute intervals for four hours. There were at the time three electric cars on the line, each towing another. As the day was a pleasant Sunday, every car was crowded.

During the same time current and potential readings were taken on the line at the station. The average gave 30 horse-power, or an average efficiency of 54.6 per cent. for the total time. Every moment deducted that no current was flowing would raise this efficiency. At times the efficiency was far higher than this.

The road conditions were severe, the grades ran as high as 10 per cent., and had numerous others of five and seven per cent. The extreme current fluctuations were noted in one minute's variation from 45 amperes to 140. The potential was very constant.

On another small road the extremes varied from the friction load to nearly 85 h. p. on an 100 h. p. engine. These extremes would happen even during the time a three impression card was being taken. Under such conditions the question of coal economy is a troublesome one. On large roads, unquestionably a far better showing would be possible.

Laying aside the question of coal economy, which is cheap in comparison to food for horses, the best engine is the one that handles the average work with the least repairs. On some small roads the ratio of engine friction to average daily load may be large. The great majority of roads, however, will have a sufficient number of cars to so reduce the ratio of extremes to the average load that the engine can work at its most economical point of cut-off the major part of the time, and raise the average load to such a point above the friction load that the per cent. lost will be comparatively small.

Almost the first question asked by the manager of an electric light company when an application has been made to him for power, is: "How much electric power must I allow per car?" No man can give a definite answer to this question that will meet all conditions.

If the following facts are known a fair judgment can be made, although I am much afraid that the accuracy of the judgment would not be a William Tell:

(1.) Number of cars simultaneously operated.

(2.) Speed and nature of service.

(3.) Maximum grade, and number of grades.

(4.) Scheduled location of cars in reference to grades.

(5.) Motor cars to be used to tow other cars or not.

(6.) Any peculiarities in regard to the distribution of cars.

(7.) Condition of track.

(8.) Location of track in reference to power house.

A moment's thought over any one of these points, I think, will convince you of its importance.

On a portion of the Cambridge division of the West End Street Railway Company's road, of Boston, the Thomson-Houston Company's motors commenced running February 16th, 1889. Up to July 1st 165,781 miles, and 25,505 round trips had been made with a loss of but 325 miles, or .19 of one per cent., and 49 round trips, or the same per cent. of loss. During this time nearly 1,500,000 passengers were carried. This, in view of the fact that during the entire time, one and part of the time two tow cars were drawn, is remarkable. It must also be known that the route extends over one of Boston's most crowded business thoroughfares, and is the main street connecting Cambridge and Boston. On a portion of the route there is an open bridge about 1,800 feet long on which is located one draw, which is opened from 20 to 30 times per day.

Over this bridge 1,810 cars per day passes, or on the average of one every three-quarters of a minute, and at some portions of the day they run at half-minute intervals. The teaming on this street is also very heavy, necessitating constant stopping.

You will see from these figures what the loss of current or a motor burnout causing delay would mean. Our record, however, has been magnificent.

As the dynamos are run by the Cambridge Electric Light Company, and are so arranged that the same engines furnish power and lights for their own purposes, as yet only approximate data as to the fuel consumption, etc., has been possible.

A few electrical tests have been made, as well as it were possible. Ammeter and voltmeter readings were taken at the station every 15 minutes, four readings per minute, or at 15 second intervals. This was kept up from 6.30 A. M. to 12.30 A. M. next morning for five days. In all, 1,480 readings were taken. The average of these readings gave for 12.6 cars in continuous service, 111.6 amperes, 500 volts, or 74.8 h. p. Per car this is 8.8 amperes and 5.9 electrical horse power. The average number of passengers carried was about 58 per round trip. We now have 32 cars in operation, and observations, in so far as they have been taken, show a marked decrease in h. p. per car. At Richmond, Va., some rough tests gave the electrical horse-power required per car at the station as from 4 to 5. On the Asbury Park road, at Lafayette, Ill., the figures of Dr. Bell show the remarkable low figure of 2.5 electrical horse power. There are a number of circumstances on this road that would tend to make this figure so low. The cars are smaller than those ordinarily used, and I should judge that there were other circumstances entering into the calculation that would tend to reduce it. However, it well shows, possibly, one extreme in railroading.

The other extreme might be cited in the case of the Lynn road, Highland division. Here only one car is in operation. In the course of its route it ascends a hill graded at the rate of 8.7 per cent. for 300 feet, and immediately passes down on the other side. In this case the engine was indicated. Five cards were taken when the car was ascending the grade, the average of which was 52.2 h. p. If we allowed a dynamo efficiency of 90 per cent. this would indicate an electrical horse power of 47 h. p. This is, unquestionably, a very extreme and exceptional case. I might add, incidentally, that the car pays handsomely.

At Plymouth, Mass., a road having many heavy grades, the maximum being over 10 per cent., and operating but three electric cars each with tow cars, the electrical horse power at the station per car was approximately 7.72 h. p. On the cars the extremes vary obviously according to speed, grades, load, etc. It frequently reaches from four to five times the average value during total time. In Lynn the variation is enormous. In Cambridge the current frequently rises to from 65 to 70 amperes, or about 42 h. p. Especially is this the case on starting.

You can see from these figures the impossibility of giving only the most approximate figures in this direction unless every detail as to operation and conditions are known.

I feel, however, that on roads having no grades over 5 per cent., and operating under 10 motor cars with tow cars, 15 h. p. per car would be a safe figure for dynamo capacity. On large roads this figure could be reduced to 12 and possibly 10 h. p. per car, while on small 3 or 5 car roads with heavy grades 18 or 20 h. p. might not be any too much.

At Cambridge tests show that of the total time consumed by a car in a round trip, it was taking power only 61.8 per cent. of the time, and that 6.7 per cent. of the total time the car was stopped.

At Washington, where the streets were freer and not so thickly populated, the above figure for time when power was used rose to 66 per cent.

Neither of these roads are what you might call large. It seems, however, that from 30 to 40 per cent. of power in excess of the absolute requirements can be planned for. I do not think, however, that this can be implicitly relied upon as in other power business, since there are many factors in the general operations of a railroad system that might at any moment tax the central station to its utmost. In regard to total electrical and total commercial efficiencies, it is impossible for me or any one else to give accurate figures. There are so many fluctuating factors entering into such a determination, that, whereas, a test made to-day would give me certain figures, a test made to-morrow, or a week later, would give me entirely different figures. The time factor must enter largely into such a test.

From estimations based upon many figures, I feel certain that a total electrical efficiency of at least 70 per cent. can be obtained, and a total commercial efficiency measured from the indicated horse power of the engine to the car-wheel horse power (W. H. P.) of from 45 to 50 per cent. If the road-bed, rolling stock, and all the electrical apparatus is maintained as it should be, I hope and see no reason why this figure cannot be exceeded.

Unquestionably, to the railroad man, one of the most vital points is the cost of repairs. We all know that in so far as power is concerned, a horse power can be produced and delivered 10 hours per day the year round, with a profit at about $75 per year. The cost of maintaining a horse for only about four hours work per day on a horse car is not far from $190.

There is one point which is of vital interest to the managers of electric light companies, and that is how they shall charge the railway companies for the power which they desire. I have already shown you that it is an exceedingly difficult thing to estimate upon the requisite power, as the conditions are so fluctuating and so variable. After, however, the question of the amount of power has been settled, the next point to determine is whether they shall charge the railway company by the hour, by the day or by the car mile. We have a large number of roads already hiring power of local companies; all of the methods just mentioned are in use. Upon small roads where the schedule of the railway company is such that they have only a few cars running continuously, meeting emergencies by extras, and where the grades are heavy, a satisfactory basis has been to charge so much per day per car, the price ranging all the way from $3 to $5, $6, and even $7. When the roads are of moderate size, or are subject to many variations and sudden demands on the part of the public for better facilities, or when the line runs to some resort and the main bulk of business lay in picnics, etc., charges on the hour basis is sometimes preferred. This price varies from 15 to 30 cents per hour. On larger systems, where the schedule is definite and fixed, the mileage basis is the preferable by far. The prices on this basis range from two to six cents. You can readily see that if the cars ran at infrequent intervals, and if the morning and evening traffic was especially heavy and required a larger number of cars, while during the major part of the day only a few cars were out, the mileage basis would be quite unsatisfactory, since on the whole you would have to make steam possible for the maximum railroad output, and maintain it throughout the day. All of these estimates, however, can only be determined by knowing the local conditions and circumstances.

In the East where coal ranges from $4 to $5 per ton, naturally the prices could not compete with the railroads of the natural gas and coal regions where fuel can be obtained for almost nothing, as in some cases for 10 cents per ton.

I would like now to enter a wedge here in favor of the very best of construction. Your own experience has probably dictated that there is no economy if the original construction be put in with either inferior or faulty material or apparatus. It is more important in railroading than possibly in lighting that the overhead construction, the track circuit, the wiring of the cars and all other details be as perfect as it is possible for the best skill and brains to make them.

If the light companies would require proper and reasonable guarantees in this direction, whenever they do supply power, it would not only be a surety in regard to their own protection, but also would be a strong inducement for the very best of construction work.

The railroad man should see that it is for his interests, since there is no trouble that will consume profits more rapidly than breakdowns. There is no excuse now for electrical breakdowns. When such do happen it is either carelessness or cheap construction.

Railroading is an exact business. The cars must be ready and go precisely on time. Delays in railroading are ruinous. All such can be avoided by perfect honest work. I call upon electric light men to strongly urge this most vital of all considerations upon the railroad world. It is an experience we have gained at a tremendous cost. Is it not to our interests to see that others becoming associated with us do not suffer? Should not all electricians bend all their energies toward making this new and richly promising field a magnificent success? Have you not millions to gain and nothing to lose? Are you ready for it? Are you going to do it?

There are some 1,600 central electric light stations already located throughout the country, and some 425 railroad companies that sooner or later will have to have electric power. Is there any reason why you should not do it? I know of many a station that has to stint and save to tide over the years' dull seasons. You have no day circuits; are held by the sun to one schedule and by the moon to another. The municipal authorities jump at you from behind one post, and your commercial customers from behind the next. Stygian darkness is ever your salvation, and all conditions have to be met and illuminated by your beautiful light. You cannot afford to lose anything. Here is an opportunity for still one more chance at profit. If necessary, enlarge the scope of your charters. It will pay you. Your securities will be worth more, and can be more easily and satisfactorily placed. Railroads have an older and better standing in the financial world and on the money market than electric light companies. Can you afford to let the opportunity go by? From careful research, my own judgment would be that in many cases it would be the company's salvation. I believe the time is rapidly coming when great electric stations,

from 5,000 to 20,000 horse power are to be established. There are plants of from 5,000 to 10,000 horse power already built for manufacturing purposes. I have been told that the Calumet and Hecla plant has in the neighborhood of 12,000 horse power. The New York Steam Heating Company have about 10,000 horse power of boiler capacity in their stations at Greenwich, Conn.

There are many mills equipped with power of from 1,000 to 5,000 horse power. Even our ocean steamships are plants of from 8,000 to 12,000 horse power. Why cannot electric plants of such power be built? Why are they not? Is there not business enough in lighting, power and railroading? Almost every station I go into the country over is adding to its capacity. "New occasions teach new duties, time makes ancient good uncouth." The horse is uncouth. Electricity is our life.

Mr. Morrison: Mr. President, your committee on nominations beg to make the following report: We recommend Kansas City as the next place of meeting of the National Electric Light Association. We recommend further for the officers of the Executive Committee of the Association, the following named gentlemen:

G. W. Hart, Kansas City, chairman; L. A. Beebe, Hutchinson, Kansas; J. A. Corby, St. Jo., Mo.; B. E. Sunny, Chicago, Ill.; S. S. Leonard, Minneapolis, Minn.; C. R. Fabian, Toledo, O.; P. H. Alexander, of New York; Frank Ridlon, of Boston; J. F. Morrison, of Baltimore.

Mr. Whipple: I desire to make an amendment to the report of the committee if that is in order.

The President: An amendment to the report of the committee will not be in order.

Mr. Whipple: You cannot prevent the motion—it is very important.

The President: Preliminary to that there should be a motion to adopt.

Mr. Lynch: I move that we adopt the report.

The President: It is moved and seconded that the report of the committee submitted through its chairman, Mr. Morrison, be adopted.

Mr. Whipple: I am very sorry that I am obliged to name a place where I hope this Convention will meet next time, which is not Kansas City. I am authorized by the Board of Directors of the St. Louis Exposition, to invite this Association to hold their next Convention in their building in February next. They have unlimited facilities there for the holding of this Convention, and those facilities they offer to this Convention free of cost. The facilities consist of unlimited horse-power something like 2,000 horse-power, and plenty of space and music halls in which to hold the meetings. I move to amend by substituting St. Louis instead of Kansas City.

Mr. D. R. Russell also spoke in favor of St. Louis.

Mr. Duncan: As I understand, we are acting upon the report of this committee in regard to officers.

Mr. Morrison, chairman of committee, stated that the committee had finally decided in favor of Kansas City on account of reduced hotel rates and convenience of hall to the two leading hotels.

The President: The question is on the motion of Mr. Lynch to adopt the report of the committee—the question is on the amendment of Mr. Whipple to substitute the name Kansas City in the report of Mr. Morrison. (The Chair calls for the ayes and nays, and upon receiving the same, stated that it was not decided. A rising vote was called for, and there were 14 in favor of the amendment, 13 opposed to it.)

The President: The ayes seem to have it.

Mr. Morrison: I call for a re-count of the vote.

Mr. Whipple: Mr. Chairman, how many times do we vote after the Chair has decided a thing carried. The decision was that the amendment was carried.

Mr. Morrison: The gentleman is out of order.

The President: The gentleman is out of order, as the decision was not rendered. I think the position of the gentleman from Baltimore is correct. (On taking a rising vote the second time, there were counted 19 in favor of the amendment proposing St. Louis, and 11 opposed to it.)

The President: The ayes have it.

Mr. Morrison: Now, Mr. President, before a decision is rendered in this case, I want you to make one other decision; that is, whether we are operating under the new constitution or under the old one.

The President: Under the new constitution

Mr. Morrison: Then the vote had now is null and void, because the vote is confined to active members.

Mr. H. A. Reed: Mr. Morrison himself stated yesterday that this constitution could not go into effect until February next.

Mr. Morrison: Many points about the new constitution do not meet with my approval. This Convention to-day is a convention of supply men and not of central station men. If you are acting under the new constitution the vote is by the central station men and not the supply men. This constitution has been unanimously accepted by this Association.

Mr. Reed: I have no choice at all between these two cities. I would just as leave go to one as to the other. The question that I would like to ask is, as to whether the President decided that this constitution is binding upon this Association at this time, at the moment of the acceptance—not the adoption—where no chance was given for discussion upon this important subject; and if we people are kicked out and told we will take your brains and your money, but we do not want your vote. I want to know whether that is admitted now, or whether it does not take effect until next year, as Mr. Morrison himself said yesterday it would.

Mr. Morrison: You have kicked yourselves out; you adopted the constitution which bars you out.

Mr. Reed: Excuse me, but there has been no adoption here yet.

Mr. Morrison: The Chair has declared that we are operating under the provisions of this constitution.

Mr. Reed: There was a protest. It was ruled out of order.

The President: I greatly regret that this discussion has arisen, as I took this whole movement in the kindest spirit, as originating among those members of the Association who are most affected by the proposed action; and the committee who submitted this amendment, three of them belong to that class; the chairman, Dr. Moses, Capt. Candee and Mr. H. D. Stanley, and those sentiments that have been expressed upon the floor of this Convention surprise me and pain me more than I can express. But, as I am called upon by the gentleman from Baltimore to decide the point raised by him, I must do what I consider my duty, and I decide that the point raised by him is well taken

Mr. Whipple: Let me say that it was not we who adopted the constitution; it was not we who had a chance to express our sentiments upon that constitution. We had no opportunity at all. The attempt was possibly to stifle any discussion at all. That point was carried out very well. But, Mr. Chairman, are we here as a set of fixtures, or are we here for fair play? And shall the sentiments of those that are here be stifled? Irrespective of where this Convention goes, there is a much more important question for this Convention to decide, and that is whether the major portion of the people attending this Convention shall rule, or whether a few men shall. We have taken two votes upon the question of St. Louis, and St. Louis has carried it by a very large majority. Why was not this stated beforehand, so that we would know how we stood. Are we to have one constitution to-day and another to-morrow? If Kansas City had got the vote, would this question have been raised? I do not think it would.

Mr. Lynch: I rise to a point of order. I think this discussion is very much out of order. The Chair was asked to give a ruling in regard to the constitution, and decided that the new constitution would hold. My object now is to object against the ruling of the Chair on this particular thing.

Mr. Whipple: I entered into a contract with this Association last February by which I paid $20 for certain privileges. What right has this Association to violate that contract?

Mr. Godfrey: I voted for it with the understanding that the report was to be be received, which was the word that Mr. Brown used.

Mr. Brown: I used the word "accept."

Mr. Lynch appealed from the decision of the Chair upon a ruling that the new constitution takes effect at once. It was seconded by Mr. Blackwell of Vermont.

Mr. Candee: I am one of that unfortunate Committee being raked over the coals, and while I think this discussion is entirely out of order, I want to say that every member of the Association has received a circular regarding the by-laws. To these we received answers to 105, 71 in favor of the constitution adopted. It was not one of our own make, but that of a majority of the letters received. Outside of that, there are no amendments, and nothing additional or new. We thought that we were simply expressing the opinions of the Association and of the supply and central station men.

Mr. Morrison: I call for the regular order of business, and the vote as provided by the constitution on the question of the next place of meeting.

Mr. Lynch: I object. There is a motion before the house.

The President: I understood Mr. Lynch to withdraw that motion.

Mr. Lynch: No, sir; I did not withdraw it.

At this juncture a good deal of excitement was manifested, and the president requested Mr. Morrison to take the chair.

The Chairman, Mr. Morrison: What is the business now before this Association?

Mr. Lynch: The question is upon a ruling as to whether the new constitution—if I am wrong I would like to hear from the members of the Association—whether the new constitution shall be interpreted to affect this Association from the day of its adoption.

The Chairman: The appeal from the decision of the Chair is not in order. The constitution is adopted and is before you for your pleasure. Mr. Secretary, what is the next regular business before the Association?

The Secretary: Mr. Chairman, there is no business in the hands of the Secretary as far as he knows—there is no next order of business.

The Chairman: We will proceed then with the adoption of the report of the committee. Are you ready for the question?

The Chair put the question and declared it carried, and the report adopted, although the "noes" were largely in the majority.

Calls for "division" came from all parts of the house.

The Chairman: The decision of the question is made and no division can be called for after that. As there is no regular business before the Association, there is nothing left to do but to entertain a motion to adjourn. (The motion to adjourn was put and declared carried, and the Association adjourned.)

The president, Mr. Weeks, who had been a surprised witness to this exciting scene, proposed afterwards to call the Association together to review the unfortunate proceedings, but the meeting was not reconvened.

THE EXHIBITS.

The electrical appliances and supplies on exhibition, while not so extensive as that which demanded attention at Chicago, were quite interesting. That which first attracts the attention is the Brush Company's fine display in the annex, which arrests notice just before reaching the hall. In this an 80 horse motor receives current from the temporary station beneath the Oneida Community's building, over half a mile away. Power is transmitted by this to a small exciter, and also to one of the new Brush alternate generators, which latter supplies current for lighting the hall with 16 candle-power lamps, to the number of over 600. The lamps, about 100 of them, are grouped in the form of a parti-colored star over the center of the Casino stage, while in the background a rectangular board is filled, and carries about 200. The effect is pretty, indeed, when these are lighted, but unfortunately the humming of the machines was too apparent for the comfort of the listeners, and there was so much to say on the part of the various readers and speakers, that the Convention could only enjoy the brilliant illumination by fits and starts, between the vocal pyrotechnic displays of the New Yorkers, the Chicagoites and those Boston fellows.

The Brush converter is an improvement, from an architectural standpoint, on the Brush dynamo, which has been able to accomplish that very desirable desideratum—reliable and efficient electrical work. The converter is certainly a graceful, handsome affair, built with some idea of symmetry and beauty as well as efficiency, and Mr. Brush is to be congratulated on his success in both lines of advancement. The Convention is much indebted to the Brush Company for this industrial exhibit of the new apparatus.

The Excelsior Company also came to the front with a fine exhibit in the wide hallway leading to the main room of the Convention. Here were a ten-horse power arc motor, fed by the Brush current on the village plant. This in turn ran a constant potential dynamo, and this latter in addition to furnishing current for a little Daisy motor, 60 lights of 16 candles, grouped to form the letters EX. E. L. CO. These machines are all of the Excelsior Company's latest pattern, and the exhibit is highly creditable and attractive, if one may judge by the crowds of townspeople who come each night to gaze and wonder at the exhibit.

The Bernstein series lamp shed its luster in the rooms adjoining the Convention hall, and also at the International Hotel, which is close by. Fourteen lights, 25s, 50s and 100s, illuminates the large exhibitors' room to the west of the hall on the same floor, and one 100-light lamp illumines the liquid refreshment room below stairs, and also two large lights at the street entrance. At the hotel five 50-candle lamps and one of 100-candle furnish a genial and pleasant light.

During part of the exhibition the Bernstein lamps, 14 in number, with an aggregate of 775 candle power was the entire load on a 35 arc light circuit of the Brush system, a rather severe test, but perfectly satisfactory as to resulting illumination.

The American Leather Link Belt Company has a fine showing of belting, and the driving belt of the temporary plant in the Oneida Community Building is of this form of belt. Schieren's perforated belting makes part of the same exhibit.

The Western Electric Company, represented by Mr. C. H. Rudd, had on exhibition and at work in a practical way, that gentle man's ground alarm system of testing electric light (arc) circuits in operation. Briefly described, this apparatus consists of two condensers, one either side the dynamo. The opposite plates of these are connected to ground through a common path and an annunciator drop. The fall of this drop closes a bell circuit contact, which may be common to several circuits. When a ground comes on the circuit, this may either discharge the condensers or charge one and discharge the other, and in either event the drop of the shutter is assured, and notice thus given of the ground.

The P. & B. wire is shown by samples, and the portable lamp stand aids for incandescent lamps, are also exhibited by Mr. C. H. Cone, of Ansonia, Conn., who represents the Electrical Supply Company. Mr. Cone was formerly of Chicago and later of Kansas City.

The Washburn & Moen case contains hard drawn copper wire of varied sizes from number 39 B. & S. up to number 12, and rods of one-eighth and up to three-quarters diameter. A sample of two and three-eighth inch cable of steel strands which is claimed capable of 180 tons strain, an assortment of flexible cords and some smaller cables make an attractive showing, and the motto "Help Yourself," keeps somebody replacing the valuable little hand books which are given away.

The Sawyer-Man Electric Company exhibited a few lamps and distributed some interesting reading matter.

Mr. C. R. Botsford reports the Non-Magnetic Watch Company's wares rapidly increasing, based on the splendid success of their timekeepers and the undeniable fact of their non-magnetic qualities. The exhibit in Mr. Botsford's show-case was the admiration of the ladies and the envy of the men. Certainly these gems are worthy of all commendation, not only as timekeepers but as works of art—many of the smaller specimens having most beautifully enamelled and decorated cases, adorned with jewels. The non-magnetic watch is well to the front, especially among electric light men.

The Butler Hard Rubber Company had a show of battery cells, tubing, etc., which interested all the battery men, as well as the electric light manufacturers seeking fine insulation.

Military Portable Electric Light Plant.

The accompanying illustration shows a new production of the engineering firm, Messrs. Sautter, Lemonnier & Company, Paris, for the following description of which we are indebted to London *Engineering:*

It consists of a tubular boiler (Dion, Bouton and Trepardoux system); this generator is easily taken to pieces, cleaned and repaired, and steam can be raised to working pressure in 20 minutes. The mechanical and electrical part of the apparatus consists of a Parsons turbo-motor, of which MM. Sautter, Lemonnier & Company possess the license in France for applications to military and naval purposes; the speed of the motor is 9,000 revolutions per minute, and the dynamo is driven direct from it; at this speed it gives a current of 100 amperes with and from 55 to 70 volts; the intensity of the light is from 5,500 to 6,000 carcels. The carriage upon which the whole of this apparatus is mounted is carried on four wheels made of wood with gun-metal mountings; these are more easy to repair when in service than if they were wholly of iron. The weight of the carriage is three tons, which is one-third less than those of earlier patterns; a light covering protects the whole of the working parts. The carriage carrying the projector is provided with two drums, each holding 100 meters of cable of the concentric conductor type.

In marked contrast to the powerful projector are the tiny ones made by Messrs. Sautter, Lemonnier & Company which form a part of the model of the Suez canal, and are but five millimeters in diameter.

The second illustration shows a powerful projector made by the same firm, portably mounted, separate from the steam and electric plant, and adapted to military field operations.

—— The plans for the Oakland (Cal.) new electric light plant have been completed by George Carleton, superintendent of the Police and Fire Alarm Telegraph. They provide for 340 lights and 100 miles of wire, and the plant, if it is decided to adopt it, will cost $64,000.

—— The Commercial Electric Company, of Detroit, has secured the contract for furnishing Frederick Stearns & Company's laboratory with an electric lighting plant which will, to a considerable degree, supplant the use of gas, despite the fact that the firm is its own manufacturer of the latter.

—— The Westinghouse interests have secured a big contract at Washington, D. C. They will shortly erect an electric light plant in the finest portion of that city. The Westinghouse engines and system of incandescent lighting will be used. Mr. C. H. Jackson is president of the company, and the work will probably be completed by December 1.

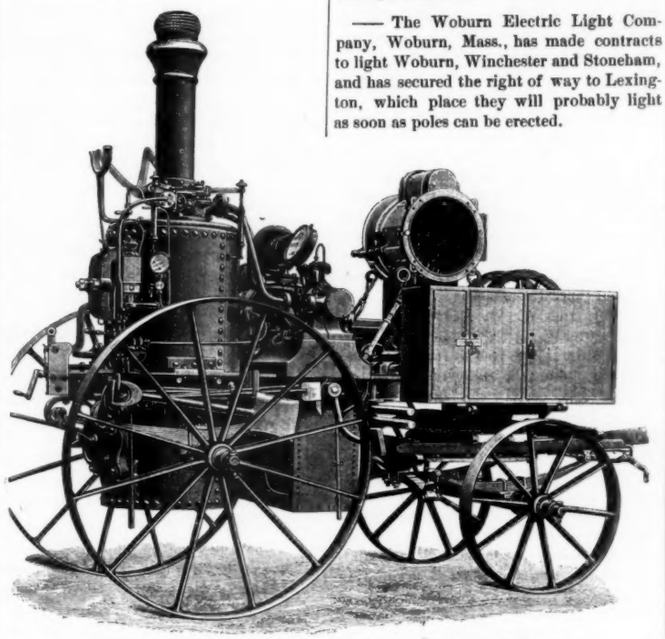
—— The Electric Light and Power Company, at Milford, Mass., has purchased a second-hand 250-light dynamo, which will be used in place of the 400-light machine. The large machine generated much more electricity than was needed; the new machine is better adapted to the wants of the company, is not so expensive and can be operated at less cost.

—— President Buck, of the Woburn (Mass.) Electric Light Company, has issued a circular to the stockholders relative to the condition of the company. He says that the new light station, a brick structure, is complete; that it is fitted with modern equipments and the most approved apparatus. The new plant has a capacity of 1,600 lights. They propose to furnish light for residences also. The present income is $20,000 per annum.

—— The City of Jacksonville, Ill., has seven electric light towers, which are used for lighting different portions of the city. There is one 125 feet high in Central Park on the square. Owing to the extreme height of these towers and the small illumination they give, the council is talking of taking the towers down and substituting lights hanging lower down, as, owing to the number of trees in the city, the towers afford but little light on the ground.

—— The Electric Light Company at Amesbury, Mass., has increased the capital stock from $35,000 to $50,000. The par value of the stock is $100 per share.

—— The Wissahickon (Pa.) Electric Light Company are adding to their plant a large boiler, an 80 horse-power engine and two dynamos, in order to supply the demand for 200 additional lights.



PORTABLE ELECTRIC LIGHT APPARATUS FOR MILITARY USE.

—— The electric light station at Holley, N. Y., was opened on Thursday evening. A throng far exceeding the capacity of the building, visited the station and commented upon it from 8 to 11 P. M.

—— The District of Columbia commissioners will receive proposals until November 1 for lighting the District by gas and electricity for one or five years. Particulars will be furnished on application.

PORTABLE PROJECTOR OR MILITARY SEARCH LIGHT.

—— A new 154 horse-power Root boiler is being put in position for the Lawrence (Mass.) electric light works.

—— Somerville, Mass., will hereafter be lighted almost entirely by electricity. A contract will be made with the Somerville Electric Light Company for 140 arc lights and 275 incandescent lights, for $20,000 per year for three years.

—— The H. H. Mills Electric Light Co., of Carthage, N.Y., has accepted the Whitestown contract, and will put in an electric light plant at that place.

—— The corporation of Campbellford, Ont., will receive tenders for putting in a system of street and domestic lighting. Tenders must be accompanied with plans and specifications.

—— The Woburn Electric Light Company, Woburn, Mass., has made contracts to light Woburn, Winchester and Stoneham, and has secured the right of way to Lexington, which place they will probably light as soon as poles can be erected.

—— The Berkeley Springs (W. Va.) Manufacturing and Improvement Company will be chartered, it is stated, to erect an electric light plant and water works.

—— The Orient Electric, Water and Gas Company have signed a contract with the Middlesborough, Md., Town Company to build electric light plant, water works, gas works and an ice factory. The electric light plant will be put in at once.

—— H. M. Cake, proprietor of the Normandie, Washington, D. C., is taking advantage of the summer season, and has just put in 600 incandescent lights.

—— A permit has been issued to the Citizens' Electric Light and Power Company, of Covington, Ky., to erect an iron building on the east side of Madison avenue between Fourth and Fifth streets.

ELECTRIC LIGHT NEWS

—— Traverse City, Mich., is now illuminated with the electric light.

—— Chariton, Iowa, is going to put in a 1,000-lamp incandescent light plant.

—— Meriden, Conn., is rejoicing in the brilliancy of 28 new arc street lights.

—— The West Troy street lighting plant has arrived and will be operated this week.

—— The Thomson-Houston Company are putting up electric lights in Goldsboro', N. C.

—— The Chester (Pa.) Electric Light and Power Company has declared a dividend of two per cent.

—— Montreal is much pleased with the incandescent street lights which were lighted last week for the first time.

—— A new Edison station, with a capacity of 25,000 lamps is said to be contemplated in Milwaukee, Wis.

—— Mayor Latrobe, of Baltimore, has arranged with the Brush Company to light the city until the September meeting of the council.

—— Franklin, Tenn., seems to be a fertile field for the electric light men just now. Electric lights will be introduced immediately.

—— The progressive proprietors of Congress Hall, Lyons, N. Y., are bound to keep abreast of the times, and are putting in electric lights.

—— The incandescent lights are being generally introduced for the lighting of stores in Birmingham, Conn., and are meeting with good success.

—— The Gas Light Company, of Bath, N. Y., has canvassed part of the village, and obtained over 120 customers for its system of electric lighting.

—— The Gloucester (Mass.) Electric Company is putting in a new alternating electric dynamo for incandescent lights. This makes the fourth dynamo placed in position at the station.

—— The Alabama Gas, Electric Light and Power Company, of Mobile, has been granted a franchise to erect gas and electric light plants. The company needs an electric light outfit.

—— The effort to raise $2,000 among the residents of Llewellyn Park, Orange, wherewith to maintain 20 electric arc lights in the park, is meeting with such success as to make it reasonably certain that the lights will be put up.

—— Messrs. Leonard & Izard have obtained the contracts from the State of Wisconsin for the electric light plants to be installed in the schools at Delavan and Janesville. The Edison system will be used and the contract includes the entire plant.

—— The electric light company in Springfield, Mass., has offered to pay for an expert forester to superintend the cutting of the foliage there when necessary in construction work, but the improvement society and the mayor have not yet selected their man.

—— The Troy Electric Light Company, Troy, N. Y., re-elected their former board of trustees, and the trustees elected A. E. Powers, president; George H. Morrison, vice-president; C. P. Kimball, secretary and treasurer, and Joseph A. Powers, superintendent.

—— The new electric lights have just been turned on in Galveston, Tex. There are at present 105 arc lights swung at the center of street intersections, and this number will soon be augmented to 175. It requires about 43 miles of insulated wire to give the service.

KINDRED INTERESTS

The Pond Engineering Company, through their Omaha office, will furnish and erect a 250 horse-power Armington & Sims engine, for the Sioux City, Iowa, electric lighting station. They have also contracted with the Laredo Improvement Company, of Laredo, Texas, for an 80 horse-power Armington & Sims engine, a 120 horse power boiler, with the necessary feed pump, heater, injector, etc., for a complete steam plant to be used in running the electric railway line in that city.

The Ball Engine Company, of Erie, Pa., manufacturers of high speed automatic engines, have made among their late shipments the following: Ionia Electric Light Co., Ionia, Mich., one 100 h.p.; Buffalo Street Railway Co., Buffalo, N.Y., one 150 h.p.; Electric Construction Co., Binghamton, N. Y., three 100 h.p; Schuyler Electric Co., Yonkers, N.Y., one 125 h.p.; H. M. Sciple & Co., Weatherly, Pa., one 100 h.p.; Bay Ridge Resort Electric R. R. Co., Bay Ridge, Md., one 60 h.p.; Chandler Iron Co., Ely, Minn., one 25 h.p.; Williamette Bridge Street Railway Co., Portland, Oregon, one 80 h.p.; Marion Elec. Lt. Co., Marion, O., one 80 h.p.; Ed. Stephenson, Waco, Texas, one 35 h.p.; Denver Elec. Illumin. Co., Denver, Col., one 125 h.p.; Pueblo Light, Heat & Power Co., Pueblo, Col., one 100 h.p.; Brainard Milling Mach. Co., Hyde Park, Mass., one 35 h.p.; American Paper and Pulp Co., Tiffin, O., one 35 h.p.; Metropolitan St. Ry. Co., Portland, Ore., one 85 h.p.; Brooklyn St. Ry. Co., Cleveland, O., three 125 h.p.; Juan Bonnister, City of Mexico, one 60 h.p.; Johnson Company, Johnstown, Pa., one 50 h.p.; Seattle Gas and Electric Light Co., Seattle, Wash., one 125 h.p.; Hygia Hotel Co., Old Point Comfort, Va., one 60 h.p.; Electric Supply and Constr. Co., Seattle, Wash., one 80 h.p.; Edison Elec. Illum. Co., Paterson, N.J., one 150 h.p.; Pierce City Water Co., Pierce City, Mo., one 60 h.p.; Tatam & Bowen, San Francisco, Cal., one 50 h.p.; Pendleton Elec. Lt. Co., Pendleton, Ore., one 100 h.p.; S. D. Elliot, Milford Centre, O., one 50 h.p.; Cincinnati Street Railway Co., Cincinnati, O., two 150 h.p.; Central Passenger Railway Co., Louisville, Ky., two 150 h.p.

The Rhodes & Keese Electric Co. of Los Angeles, has obtained the contract for furnishing the Redondo Beach Hotel throughout with electric lighting and other apparatus, costing something over $10,000. The Rhodes & Keese Company is made up of Messrs. S. J. Keese, T. H. Rhodes, W. I. Keese, J. F. Cosby and G. Wiley Wells, with the Southern California bank as treasurer. Mr. S. J. Keese is president. He has been the agent of the Thomson-Houston Electric Company in that section and organized the Pasadena Electric Light Company. T. H. Rhodes' reputation as a first-class electrician is well known throughout Southern California. His work has been satisfactory and he has enjoyed a lucrative business.

At the annual meeting of the stockholders of the Franklin Electric Co., Chambersburg, Pa., the following board of directors was unanimously chosen: S. Z. Hawbecker, W. G. Nixon, B. M. Nead, John G. Orr, G. W. Britsch, Jacob Fendrick and John R. Kerr. The board was subsequently organized by the election of S. Z. Hawbecker, president; John G. Orr, vice-president; W. G. Nixon, secretary; Van T. Haulman, treasurer; W. L. Ritchie, general manager; Jacob Fendrick, assistant general manager. John G. Orr was elected treasurer to serve during the temporary absence of the treasurer, Van T. Haulman.

A Promising New Company.

The Short Electric Railway Co. has been incorporated with a capital of $1,000,000, under the laws of Michigan, and is a Cleveland enterprise. The poles, line appliances, trucks, wheels and motors for the electric street cars, which they will put in operation, will be manufactured there, and the headquarters of the company will be at the office of the Brush Electric Company, Cleveland, Ohio. The Short Company is losing no time in bringing the new Brush motors into service, and a number of them are already being made at the Brush works. On July 26 the stockholders met in Cleveland and elected the following directors: S. H. Short, G. W. Stockly, C. F. Brush, J. J. Tracy, J. Potter, W. W. Leggett and N. B. Abbott. Mr. Leggett resides in Detroit, and Mr. Abbott's home is in Columbus. The other directors are residents of Cleveland. The first meeting of the board of directors was held in the office of the Brush Electric Company, when S. H. Short was elected president and general manager; J. Potter, vice-president, and W. W. Leggett, secretary and treasurer.

Mr. Potter is reported in the Cleveland *Leader* as making the following statements concerning the organization and plans of the new company: "The idea of the Brush Electric Co.," said Mr. Potter, "in securing control of the Short electric railway system, which we consider the best in the country, was to take advantage of the business it offered and to open up the large market which exists for the sale of electric generators and motors. The new company has large contracts on hand and is negotiating for others. We have commenced operations and expect to do a very heavy business this fall. We expect to pay from the start. The new company acquired the business of S. H. Short & Company, of Columbus, O., who controlled the Short inventions." The same paper quotes Mr. Short as follows concerning his system: "It differs from all other electric railway systems in that we use two wires overhead. These two wires are cut into sections so arranged that each section receives power only for operating the cars upon it. If there is no car on any one section there is no power in the wires of that section to injure persons or animals. There is no electricity on the rail, as I consider that dangerous to life and property. All our power is retained 20 feet above the ground. A fallen wire can be handled without receiving a shock. We can run cars up to any speed and go up hill as fast as on the level. We lose no power at the ends of the line. In St. Louis our cars are running 20 hours a day, covering 120 miles each, and the armatures and magnets never burn out. In Huntington we have a road paying 20 per cent. on the capital invested. We have a great advantage in the use of the Brush motors and generators. These appliances have lately been devised by Mr. Brush for street railway work and are entirely new to the electrical fraternity."

Electricity in Mining.

[From the St. Louis *Globe-Democrat.*]

Electricity is going to revolutionize mining, as it has already done some other industries, and the time will come when it will be the sole force used for bringing up gold and silver. Even now you can have an electric plant which will light up your tunnels, run your tramways, operate elevators in your shafts and work your drills.

Ten men with drills operated with electricity can take out as much ore and tunnel as far as 100 men with picks, shovels and blasting material. The wages of 90 men would soon pay for an electric plant. Besides, you can light your building and save insurance and oil.

Which Shall It Be?

An inquiry has been instituted to determine the best word to express execution by electricity. The answers as far as received are remarkable for the variety of suggestions. Among them are elektrophon, electricize, electrony, electrophony, thanelectrize, thanatelectrize, thanatelectrisis, electromort, electrony, electrotasy, fulmen, electricide, electropœnize, electrothenese, electrocution, electroed, electrostrike, and finally joltacuss or voltacuss.

ELECTRIC POWER NEWS.

* * A large number of the electro-matrix machines, the invention of Mr. G. A. Goodson, of Minneapolis, are being manufactured in Chicopee, Mass.

* * The Newark, N. J., City Clerk's office in the City Hall will soon be equipped with several revolving fans. The Daft Electrical Company is now at work on them.

* * The Boston *Journal* says that the European Electric Welding Company has voted to increase its capital stock $100,000, making its total capital stock $1,600,000.

* * The movement in Denver, Col., to build an electric line west of the Platte is making good progress. It is a spontaneous idea with the owners of property, and they appear to be determined to put it through without delay.

* * The Chattanooga, Tenn., Electric Railroad Company will lay a double track on their line on Broad, Second and Walnut streets. The first change to electricity on the lines purchased of the City Street Railroad Company will be on the mountain line.

* * The electric car which was tried over the Germantown Passenger Railway, Germantown, Pa., several weeks ago, was given a trial last week over the Lehigh Avenue Railroad and gave general satisfaction. It was run on the People's Line as far as Lehigh avenue and switched on to the tracks at the latter place.

* * The Denver (Col.) board of supervisors has decided that the ordinance by which the tramway company was originally empowered to lay an electric road said nothing which forbade the use of overhead wires. The enterprise was thought by the supervisors to be one of public importance and should not be impeded.

* * The Woodland street car line at Cleveland, Ohio, will not be operated by electricity until next spring. The owners of the road will experiment with storage batteries during the coming winter and will see how the motor system works during cold weather. Next spring the best of all the systems will be adopted.

* * The Westinghouse Machine Co., of Pittsburgh, Pa., report that their business is unusually active for this season of the year. Their sales during the months of May and June were simply phenomenal, and the outlook for a continuance of such sales is good. The orders received by them for the first 20 days of July, amount to 48 engines, footing up to over 3,000 h. p.

* * The 10 days within which Mayor Whelan, of Troy, N. Y., could veto the electric railway franchise having expired, the franchise is now formally in the possession of the Troy and Lansingburgh Company. The work of erecting the poles and stringing the wires along the line of the road will now be prosecuted with the utmost despatch. It will not be long before the electric cars will be running from the Iron Works to Waterford.

* * Major Butman who is putting in the electric railroad at Saratoga, N. Y., was interviewed by a gentleman of Ballston, who is largely interested in the advancement of this village until it takes its place among the live villages of the state. He says Major Butman will extend the electric railway to Ballston, provided he can get the right of way through the towns and village. A meeting of the citizens will probably be called at an early date to consider the matter.

* * Supt. Fox, of the Key City Electric Motor R. R. Co., Dubuque, Iowa, has received a telegram from New York announcing that the iron for the motor line had been shipped from Johnstown, Pa. This is the news for which the company has been waiting for months and will be received with pleasure by all except those who have so bitterly fought the motor project and thrown in its way every obstacle possible. The cross wires are now being stretched and hereafter the work will progress with great rapidity.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING AUGUST 6, 1889.

408,205 Regulator for dynamo electric machines; Hermann R. Boissier, New York N. Y.

408,206 Dynamo electric Machine; Hermann A. Boissier, New York N. Y.

408,224 Electric signaling apparatus; Willard Eddy, Haddam, Ct.

408,231 408,232 Means for propelling vehicles by secondary batteries. 408,233 Vehisen motor; William W. Griscom, Haverford College, assignor to Electric Dynamic Company, Philadelphia, Pa.

408,265 Commutator for electric machines; Sidney H. Short, Columbus, Ohio.

408,269 Electric drill; Imle E. Storey, Boulder, assignor to the Storey Electric Drill and Power Co., of Colorado.

408,279 Zinc electrode for galvanic batteries; James B. Williams, Oakland, Cal.

408,287 Secondary battery; Turner D. Bottome, New York, N. Y. assignor to John B. Tibbits, Hoosic, N. Y.

408,295 Electric meter; Sebastian Z. de Ferranti Hampstead, County of Middlesex, England.

408,327 Telephone system; John R. Smith, Neosho, Mo.

408,333 Governor for electric motors; George H. Whittinghani, Baltimore, Md.

408,358 Carbon for electric lighting; Carl A. J. H. Schroeder, London, England.

408,367 Secondary battery; N. B. Aldrich, Fall River, Mass.

408,399 Elevator alarm indicator; Ernst Axthelm, Pittsburgh, Pa.

408,403 Dynamo electric machine; Sebastian Z. de Ferranti, Hampstead, County of Middlesex, England.

408,465 Method of magnetically reducing friction; Mark W. Dewey, Syracuse, N. Y. assignor to Dewey Corporation, same place.

408,468 Magneto electric individual switching apparatus; John W. Dunlap, Sr., Pittsburgh Pa. assignor by direct and mesne assignments of part to Robert J. Shaw, Charles R. Mair, and Willis H. Rowe, all of same place.

408,478 Shield and reflector for incandescent lamps; George Gibes, Milwaukee, Wis.

408,484 Electric lock; Louis Huebner and Rudolph Busse, Schweidsnitz, Germany.

408,503 Trolley track; James H. Morley, Florence, assignor one-half to George Nightingale, Holyoke, Mass.

408,513 System of electric distribution; Frank L. Perry, Chicago, Ill.

408,544 Electric railway system; Frank J. Sprague, New York, N. Y., assignor to Sprague Electric Railway Co.

408,574 Method of introducing molten insulating material into underground conduits; David Brooks Jr., Philadelphia, Pa.

408,590 Electric motor; Stanley C. C. Currie, Philadelphia, Pa., assignor to United Electric Improvement Co., Gloucester City, N. J.

408,607 Electric drinking vessel; Frederick W. Flint, Mount Airy, Ga.

408,629 Method of producing battery solutions; W. P. Kookogey, Brooklyn, N. Y.

408,638 Contact arm for electric railway motor cars; Charles J. Van Depoele, Lynn, Mass.

408,639 Underground conduit for electric railways. 408,640 Multiple motor, electric locomotion. 408,641 Alternating current motor. 408,642 Inductional electric motor; Charles J. Van Depoele, Lynn, Mass.

408,647 Electrical resistance; F. O. Blackwell, New York, N. Y.

408,666 Secondary battery; James F. McLaughlin, Philadelphia, Pa.

408,671 Railway signal; Joseph W. Riggs, St. Paul, assignor to the Riggs Electric Traveling Danger Signal Co., Minneapolis, Minn.

408,676 Electric call bell; Thomas J. Smith, Brooklyn, N. Y., assignor to E. S. Greeley and Co., New York.

408,678 Electric switch; Walter Thompson, Orange, N. J.

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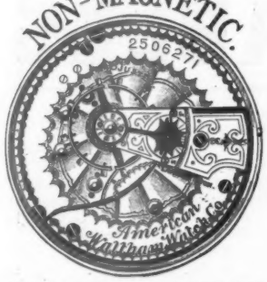

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Suits are now pending in the U. S. Circuit Courts against infringers of the Bogart Patents in the cities of New York, Philadelphia and Boston.

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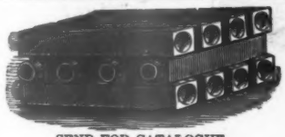

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(No. 197.) TORPEDO STATION,
NEWPORT, R. I., March 11, 1887.

THE OKONITE COMPANY, 13 Park Row, New York City.

Gentlemen:—The sample of lead covered sent here for examination shows an insulation resistance of 1250 megohms per nautical mile after twenty-four hours in salt water. The insulation of one length of about 150 feet appears not to have been affected by immersion in salt water for two months.

The conductivity is 98⅞ per cent. of that of pure copper.

Respectfully, C. F. GOODRICH,
Commander and Inspector of Ordnance in charge of Torpedo Station.

In Dec., 1888, Commissioner Goodrich wrote fully corroborating the above.

SUB-MARINE
UNDER GROUND
AER IAL

EXECUTIVE OFFICE,
WESTERN UNION TELEGRAPH COMPANY.
NEW YORK, June 6, 1887.

Dear Mr. Candee:—Replying to yours of the 28th ult., my experience with the Okonite Core, for something over two years, has been very satisfactory.

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J. N. KELLER,
General Manager.

January 9th, 1889, William J. Denver, then General Manager, wrote fully confirming the above.

13
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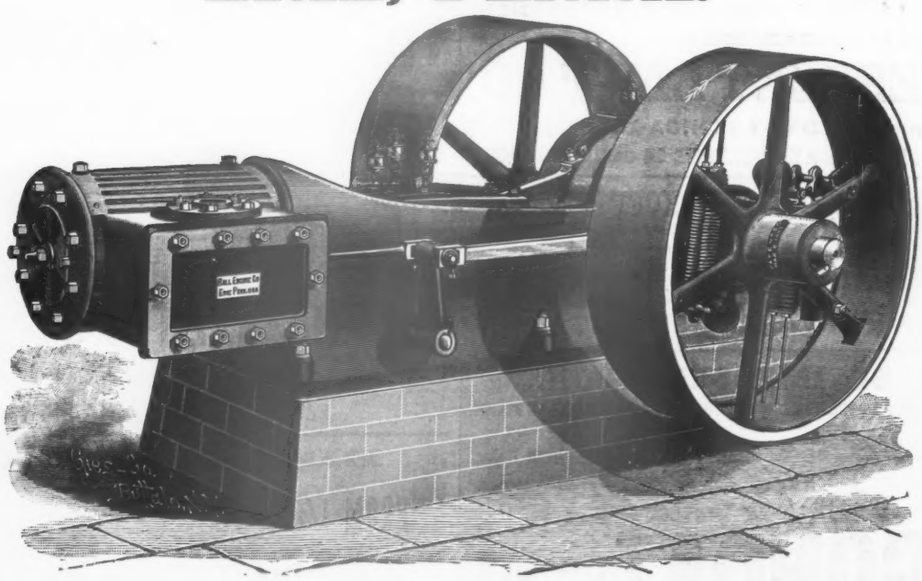

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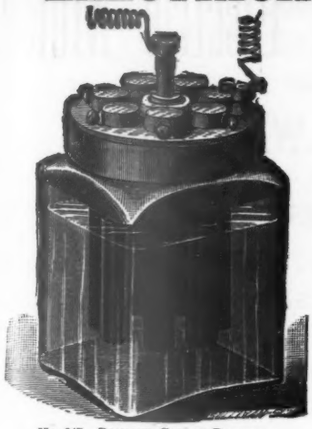

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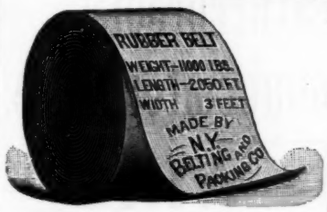

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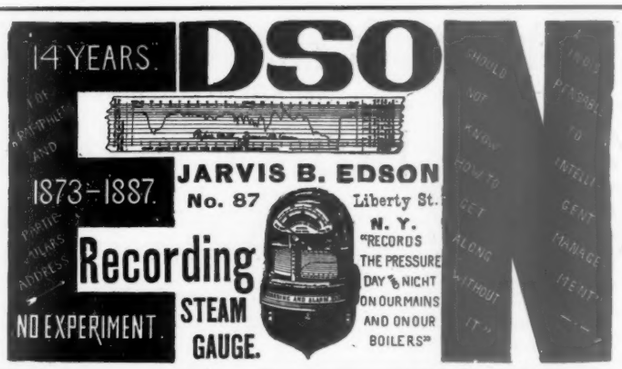

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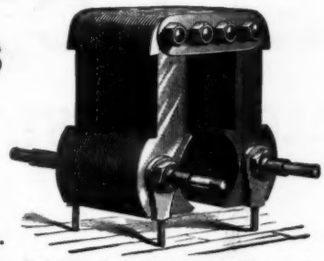

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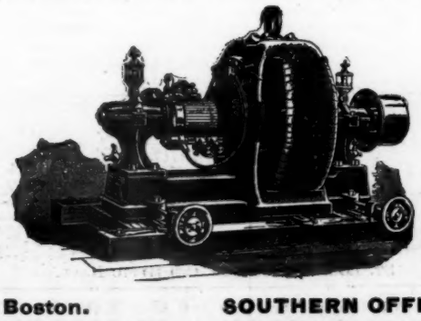

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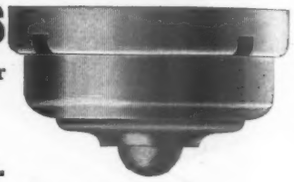

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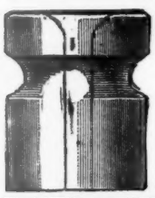

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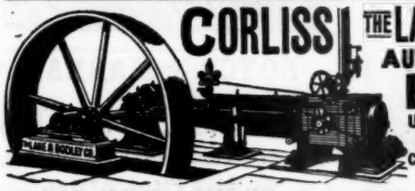

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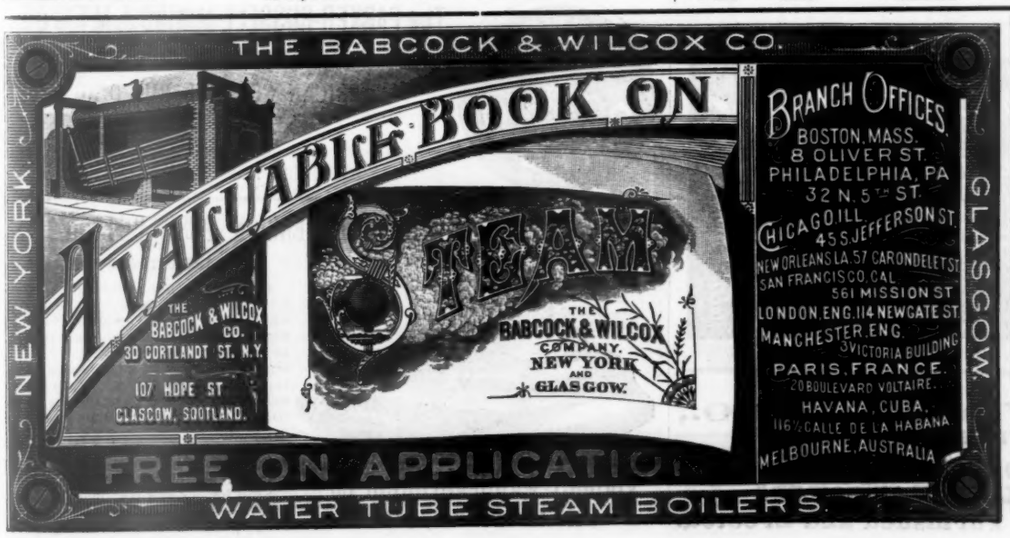
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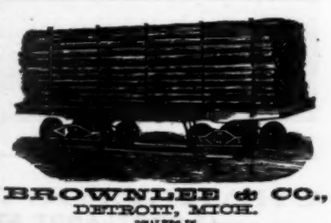

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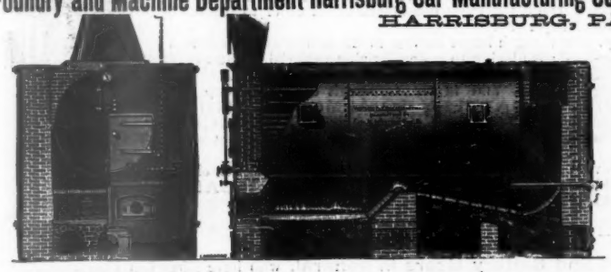

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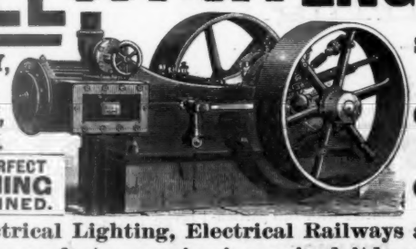

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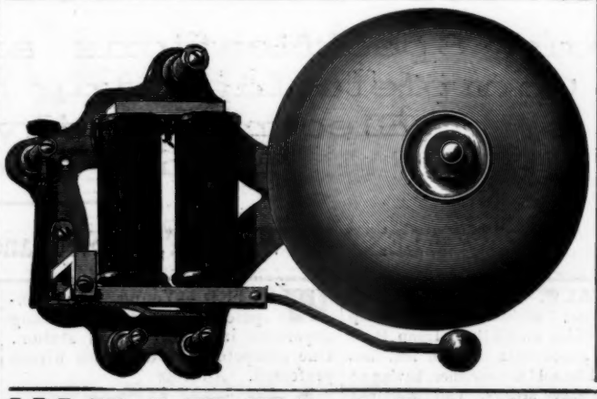

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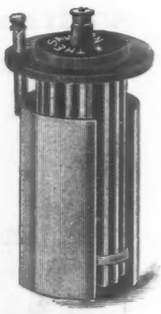

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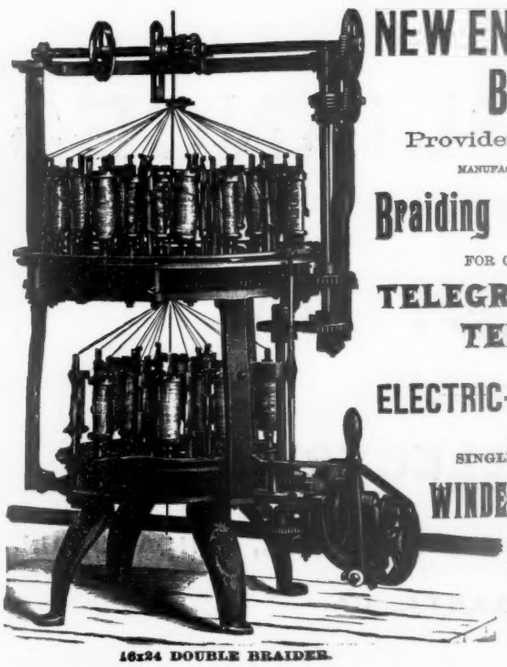

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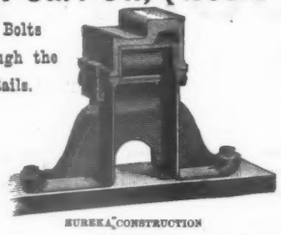

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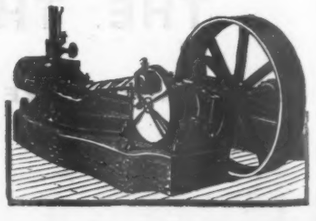

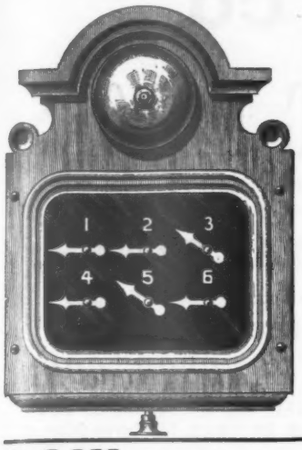

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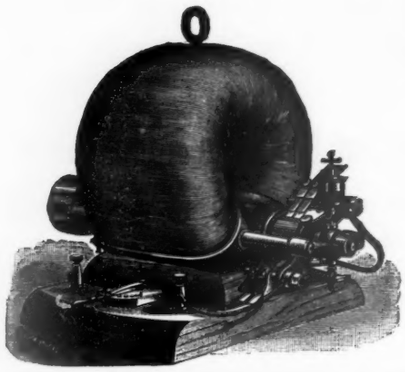

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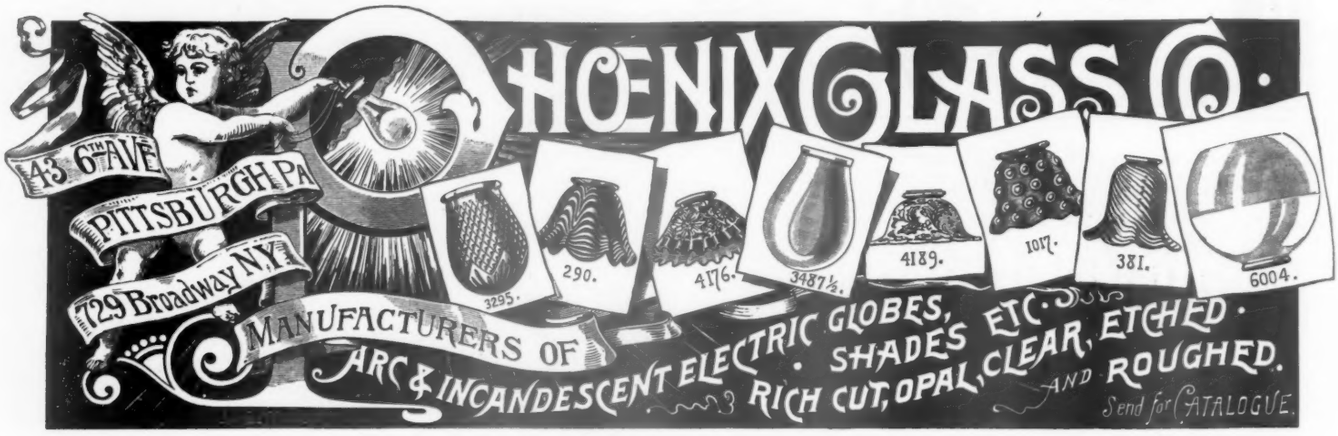

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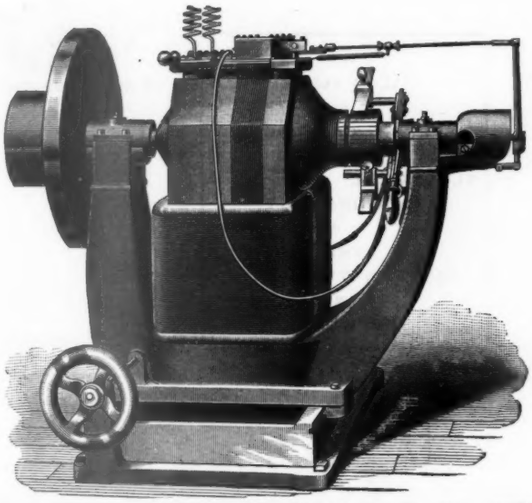

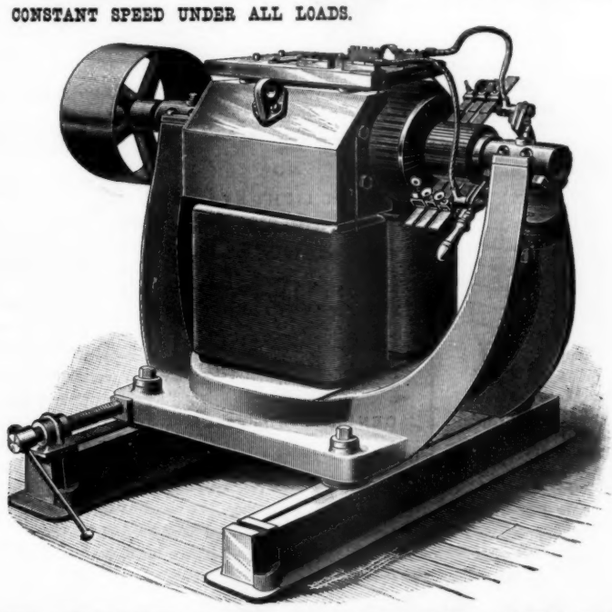

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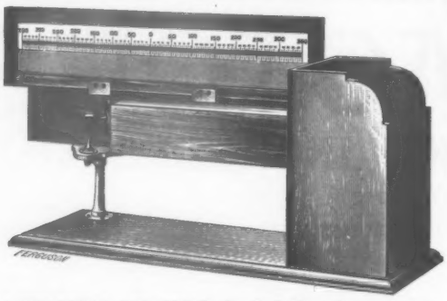

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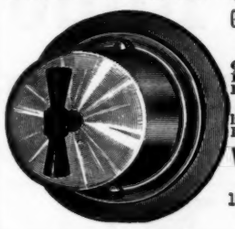

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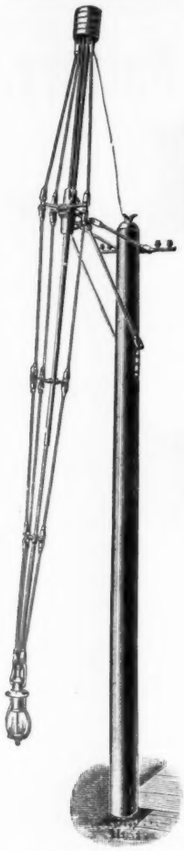

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THIS PAPER WAS PREPARED FOR THE NATIONAL ELECTRIC LIGHT ASSOCIATION BY MESSRS. REMINGTON & HENTHORN, AND READ BY MR. JOHN T. HENTHORN.

"THE THEORETICALLY PERFECT ARC LIGHT STATION," A PAPER BY M. D. LAW, ALSO PUBLISHED HEREWITH.

It is without doubt generally conceded by the managers of electric lighting stations that the main, if not the vital, practical problem ever present for their consideration is how to best reduce the cost of the running expenses of the station. We state this advisedly because the stage of doubt and uncertainty, coupled with experiment, has long since passed, and the business of producing electricity commercially is one of the leading interests of to-day, not only in this country, but in the world at large, and is being rapidly extended.

The reasons why it is so desirable to lessen the cost of the production of electricity will readily suggest themselves to the practical mind. We would, however, venture the opinion that one, but not the least one, may be found in the desire to increase the earnings which is returned to the stockholders with more or less frequency in the form of dividends.

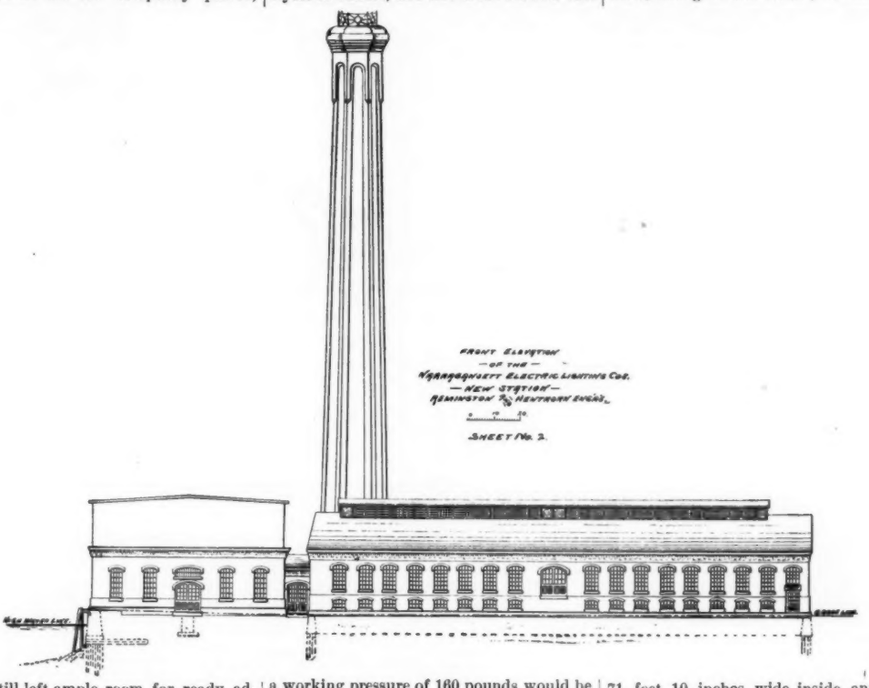
In view of this condition of things pertaining to matters electrical at the time to which our attention was attracted to this subject, we at once gave the matter serious consideration, and came to the conclusion that for the present, at least, the most needed and radical improvements should bear directly upon the steam plant, and also to the mechanism employed in transmitting the power thus generated to the dynamos.

At or about the time to which we have just alluded, M. J. Perry, Esq., the efficient general manager of the Narragansett Electric Lighting Company, of Providence, R. I., commissioned us to design and plan the arrangement of the entire motive power and machinery, as well as the buildings and chimney necessary to the completion of a proposed first-class electric lighting station, which might be expanded to an ultimate capacity of some 12,000 horse-power.

The site for the new station is on the west side of the Providence River, and just north of the Point Street Bridge. The lot comprises some 55,000 square feet of land, bounded on the north and south sides by public streets, and a water front forming the east side.

In the preliminary plan (which was afterwards adopted) the new station was represented as having two dynamo buildings, each 60 feet by 200 feet—one on each street—the number of dynamos to be provided for in each building being about 80, of an average capacity of 50 to 60 arc lights; the dynamo-houses being united along the west side or end by a building used for offices, storehouses, etc.

The dynamos are so arranged that a much greater number than usual are located in a given floor space. Notwithstanding that this statement might lead one to infer that the machines are too compactly placed, there is still left ample room for ready adjustment, inspection, etc. All the dynamos in each building are driven direct from pulleys rigidly secured to a main line shaft located below the dynamo-room floor. It will be seen that this arrangement of buildings forms a hollow square, open on the east side. In this space, which is covered by a well lighted and ventilated roof, are located the engines.



In view of the fact that the employment of the best type of compound engines is being constantly extended to effect a considerable saving of steam (or fuel), it was decided to adopt for the station triple-expansion compound engines, provided with independent surface condensers and circulating pumps, the initial steam pressure being 160 pounds.

As the lot has a water frontage of sufficient depth to allow vessels to lie alongside, it was decided to locate the boiler-house on that side, the plan being to discharge the coal from the vessels directly into coal buckets of large capacity built into the roof of the house, from which, by a series of suitably arranged chutes and pipes, the coal is delivered by gravity to the front of the boilers.

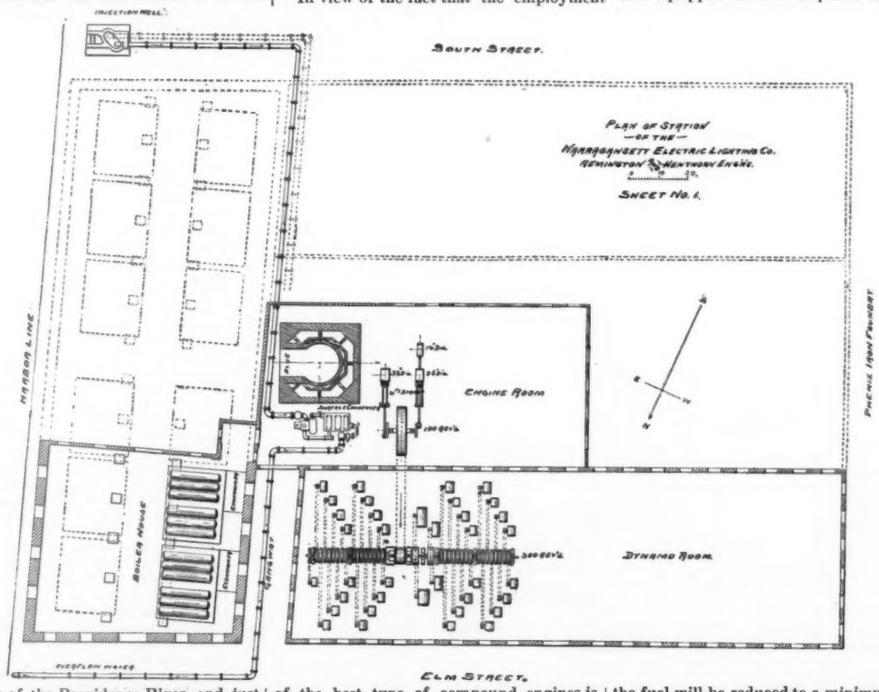
The water-tube type of boiler was selected as possessing greater advantages over their styles of boilers, and also from the fact that a working pressure of 160 pounds would be required.

To the rear of each battery of boilers is located, in the main flue, an economizer for increasing the temperature of the feed water. By means of short branch flues provided with dampers, the economizer may be cut out as desired and the waste gases pass directly to the chimney. It is the intention to introduce mechanical stokers soon. When thus equipped the labor required to handle the fuel will be reduced to a minimum.

The chimney is made sufficiently large to produce ample draft for the entire series of boilers. It is located directly west of the boiler-house, and adjacent to it, and extends through the engine-house roof. The size of the flue itself is 14 feet in diameter, and some 235 feet high above the engine-room floor.

By means of the machinery, etc., thus outlined, together with others of special design, all of which will be hereinafter described, it is confidently expected that the actual cost of the mechanical generation of electricity will be reduced to a lower figure than any other station having substantially the same capacity.

The buildings constructed thus far, and what was deemed of sufficient capacity for the present with a large margin for growth, is a dynamo-house 200 feet long and 60 feet wide, facing on Elm street; a boiler-house 71 feet 10 inches wide inside, and 68 feet long running lengthwise, and directly on the Providence River, which is of ample capacity to develop 4,000 indicated horse-power by the engines, and an engine-house 57 feet wide and 110 feet long. These structures are of brick, of plain design, having granite underpinning and brown stone sills for the windows, and may be considered practically fire proof, as the only wood entering into their construction is that of the window frames and floor. The chimney, although not as yet finished, is of 14 feet internal diameter, 28 feet 6 inches square at the base, and 238 feet high from high water line; this structure alone will require 1,500,000 bricks. These structures are shown in elevation on sheet 2.



The plans of these several buildings are shown on sheet No. 1, and are represented by full lines, while the dotted lines represent a similar building upon the South street side, with an engine-room intervening, ultimately to be 73 feet by 200 feet long in the clear without any posts, and the boiler-house extended the full width of the lot, or 71 feet 10 inches by 200 feet when eventually carried out as necessity demands. It will therefore be seen that ample provisions for extension have been made, and which may be carried out without in any way interfering with the regular daily operations of the station, or undoing what has been done on the permanent structures. The end and side wall of the engine-house and also the end of the boiler-house are of a temporary nature, although built of brick.

DYNAMO-HOUSE FOUNDATIONS.

The character of the foundation which we had to deal with through all of the work of construction was that which one would naturally expect in dealing with a public dumping ground, which, while forming a very solid upper crust, was overlaying a strata of dock mud and blue clay, which, when once entered, was as unstable as oil; underlying this was sand, and finally hard pan was reached at a depth varying from 35 feet to 50 feet below high water.

The unreliability of this material determined that piling should be driven for all of the permanent walls of the buildings; and the specifications for the dynamo-house foundations, which were the first started upon, were so drawn that piles of 30 feet in length, increasing towards the river to 45 feet in length, should be driven; and the whole, which were of spruce, and each being 11 inches diameter, were cut off 36 inches below established high water. These piles, 216 in number, were driven alternately in two rows 32 inches center to center at right angles to the wall, and 64 inches cen-

ter to center parallel with the wall, each row being surmounted by 12 inches by 12 inches hard pine timber pile caps. Upon these caps was started the masonry wall, four feet three inches wide at the base, tapering to 24 inches at the top on the four-foot level above high water. This wall was, as for all others, laid in cement mortar in the proportion of one of cement to two of sand.

The assumption as to the length of the piles to be driven, proved, from the nature of the surroundings, to be correct; as, when driven at the farthest or west point from the river, hard pan was reached at a level of from 35 feet to 38 feet below mean high water, and from this point towards the shore the strata gradually dipped to a level ranging from 50 feet to 53 feet below high water.

This piling is shown on sheet 16.

DYNAMO-HOUSE.

The walls of the dynamo-house are, as before stated, 60 feet wide in the clear, and 200 feet long, and are 20 inches thick from the foundation up to the level of the dynamo floor, which is about seven feet nine inches above the average grade of the sidewalk; thence it is reduced in thickness by a pressed-brick belt course to 16 inches, and carried up to the 29 feet 3 inch level, thus leaving 17 feet from the dynamo floor to the under side of the wrought iron-trusses, as shown in section on sheet 3.

The house is covered by a wrought-iron truss roof made by the Berlin Iron Bridge Company, East Berlin, Conn.

The trusses are placed 10 feet center to center, the rafters of which are made up of 10-inch plate iron with 2x2 inch angles riveted thereto, and the lower cord of 2x2½ inch angles; the struts or braces are 2x1¾ inch angles. The purlins running lengthwise with the building are of 2x2 angles spaced 25½ inch centers, and upon which is placed the roof covering.

Upon the roof is a ventilator eight feet wide and five feet high, running 170 feet longitudinally of the building; to the sides of the ventilator are bolted double-glazed windows, so arranged as to be opened from below for ventilation. There are three half panels on each side of the monitor, which are covered with corrugated iron, the remaining portions of the sides, and also of the ends, being of glass.

In the design of the building no attempt was made at ornamentation, the main object being to provide ample light and ventilation in connection with means for properly and economically caring for the machinery placed therein.

To prevent any condensation from taking place on the under side of the iron roof, due to the difference in temperature within and without, which would be extremely objectionable and dangerous in buildings used for this purpose, the following described non-conducting covering was devised: Upon the purlins of the roof is first tightly stretched galvanized iron wire netting of 2-inch octagonal mesh, thus forming a foundation on which to place two layers of asbestos board, the edges of each sheet overlapping about two inches on its neighbor, the two layers breaking joints with each other. On this is laid a covering of tarred paper mopped over with hot asphaltum, and finally a second layer of tarred paper is applied, and also breaking joints with the lower layer upon the hot asphaltum, thus completing what is intended to be a dry and incombustible sheathing; and finally upon the whole is then placed the No. 24 galvanized corrugated iron covering, the same being secured every five inches fore and aft to the purlins below.

The roof covering is shown on sheet No. 6.

DYNAMOS.

In the general layout of the dynamos, provision has been made for placing four rows on each side of the center line of the house. The dynamos are placed diagonally with each other in sections or blocks of four, as shown on sheet 7.

Each machine is supported upon a substantial brick foundation laid up with cement; the several 12-inch walls forming the foundations of each series are bonded together, and, in fact, all built at one time, so that the foundation for one machine acts as a brace for its neighbor.

Between these foundations and the walls of the building is a wooden floor of ordinary mill construction.

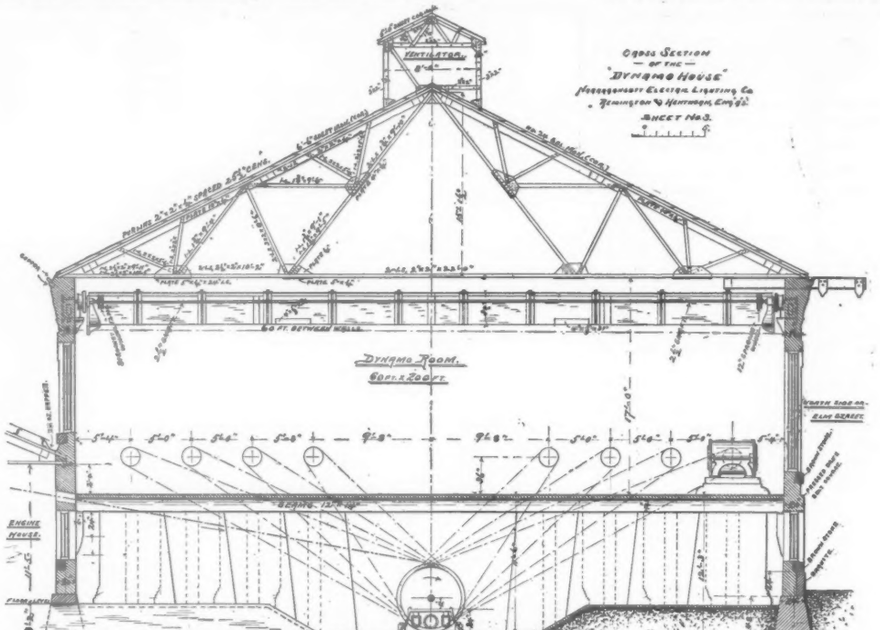
Directly beneath each machine is left open a section of floor for a thorough ventilation of the armature, through the medium of the cool, although perfectly dry, basement below.

All of the dynamos are belted down through the floor to pulleys rigidly secured to the main shaft, the machines being started or stopped at will by an appliance hereinafter described.

The ultimate capacity of this first dynamo house of the station will be about 80 machines of the ordinary 50 or 60 arc light size, although much more power may be installed by the introduction of machines of greater capacity than that represented above.

The station will be started with about 35 or 40 machines in service, and when enlargment becomes necessary from time to time, the line shaft will be extended as desired, and the available floor space left for that purpose will then be utilized.

The dynamo-room is thoroughly lighted on the sides and ends by large windows, all of which, excepting those on the south side or engine-room side, are of three sashes; the combined height being 10 feet, and the width four feet eight inches. The windows are placed 10 feet, center to center, and the sills 23 inches above the dynamo floor, and being sufficiently low to influence the proper ventilation of the dynamos.



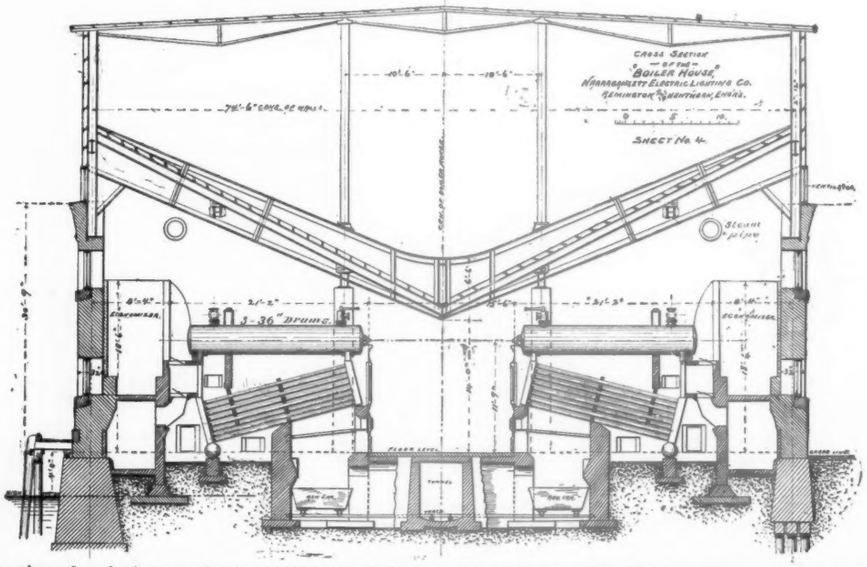
CRANE.

Directly underneath each truss of the dynamo-room, and bolted thereto, is built in each side wall a chair or casting for supporting the tracks for the traveling crane, which was deemed essential for moving the dynamo machines from one location to another in an expeditious and economical manner.

These tracks are of nine-inch rolled I-beams, weighing 70 pounds per yard, and were cut in 20-feet sections, the bottom flange being bolted to the cast-iron chair, and the ends strapped together by a plate and bolted.

The box girder proper was constructed by the Berlin Iron Bridge Company, and is 58 feet in length, end to end, and made up of two plates 30 inches deep, stayed and stiffened on the side by ¼-inch gusset plates, riveted, between two 3x3 inch vertical angles on the plate girder. Across the top is placed at a corresponding distance (five feet five inches) two 4x3 inch angles six feet long, to which also are riveted the gusset plates. At the top to the vertical plate on the outside, and at the bottom on the inside, are riveted 4x3½ inch angle irons, the lower angles forming the track for the trolley, which runs lengthwise with the crane.

The sides of the girder are further stiffened and braced by a system of three-inch by two-inch diagonal angles, all of which, by reference to sheets 8 and 9, will be clearly defined. Each end of the girder rests in a cast-iron chair, and is bolted and riveted thereto. At the extreme end of this supporting chair are located, 72 inches apart, the friction roller wheels, which support the whole; and by means of a shaft operated by a chain from below, and a system of spur gearing acting upon one friction roller wheel at each end of the supporting chair, the whole is propelled lengthwise of the building. A chain is also used to propel the trolley across the building or lengthwise of the box girder. The whole were made from plans designed by us.



BELT SHIFTER.

The device adopted for shifting the dynamo belt is such that loose pulleys and clutches are entirely dispensed with, the pulleys being rigidly secured to the shaft. The arrangement consists (for each dynamo-driving pulley, the same being 60 inches in diameter), of a curved standard or frame secured to and extending up from the floor somewhat above the center of the shaft. Each side of the frame is provided with a series of narrow guide-rolls, the centers of which are arranged in a half circle, whose diameter is somewhat less than that of the pulley, the curved frame in cross section being U-shape; the pulley continuously revolving in the space lying between the two sides.

To the rear of the 60-inch pulley, between it and the dynamo and intermediate of the upper and lower side of the belt, is mounted a short shaft parallel with the main shaft, having two chain wheels thereon, separated from each other by a distance exceeding the width of the pulley. Two endless chains (made up of flat links) are carried by this shaft and supported by the guide-rolls before referred to. A portion of the chains, or flexible apron, is provided with two-inch wooden rolls, the same extending across and uniting the two chains; the under side of the rolls being some half inch or more above the periphery of the pulley when the belt is shifted.

In order to shift the belt, the dynamo is first operated by the usual screw or equivalent device to slacken the belt somewhat, to be immediately followed by operating a lever which carries the wooden rolls ahead from the normal position, thereby engaging the inner face of the belt, and, as the chain advances, lifts the belt radially away from the pulley, the belt then being stationary and the pulley revolving.

To start the dynamo the operation is reversed; that is, the flexible apron is revolved rearwardly, thereby carrying the rolls from the proximity of the pulley, and allowing the belt to re-engage the pulley; the dynamos at the same time being actuated to tighten the belt. This device is indicated on sheet No. 10.

ENGINE HOUSE.

The engine-room (see sheet 5), as at present completed, is 57 feet wide and about

110 feet long, and covered by an iron truss roof, also made by the Berlin Iron Bridge Company, and of practically the same design, and non-conducting covering, as for the dynamo-house. When necessity demands, the house will be lengthened by the removal of the temporary end party-wall, and the extension of the present iron roof up to the west end of the dynamo-house.

The change above contemplated will then accommodate sufficient engine capacity for the first dynamo building, and upon the ultimate addition of the second dynamo-house upon South street, the engine-room will become about 73 feet wide, and without any posts. To accommodate this additional width, provision was made in this present roof for splicing out the trusses, and thus the two sides of the roof would then become alike. This can be done without at all affecting the operation of the station, a condition throughout the entire work which we have always carefully considered.

Below the floor is located the first leg of the 26-inch exhaust pipe, and above and supported upon the wrought iron trusses is the 18-inch wrought iron steam pipe. These two pipe lines will ultimately form a U-shape, that is, passing up one side of the room and returning down the other.

ENGINE.

The engine, which is of the triple-expansion type, was especially designed for the service of the station by E. Reynolds, general superintendent of E. P. Allis & Co., of Milwaukee, Wis.

The high pressure cylinder of the engine is 14 inches in diameter, the intermediate cylinder 25 inches in diameter, and the low pressure cylinder 33 inches in diameter, each 48-inch stroke.

The working barrels of each cylinder, together with the heads, are thoroughly jacketed with steam at boiler pressure, also the receiver between the high and intermediate cylinders; and that between the intermediate and low pressure cylinders are likewise jacketed by steam at boiler pressure.

The valves of all the cylinders are located in the heads, and as the working faces of the valve with this construction are within a very short distance from the face of the heads, the waste clearances are reduced to a minimum.

The valve gear is of the liberating type, the valves themselves closing by vacuum pots located level with the engine-room floor.

The automatic cut-off mechanism of the first and intermediate cylinders are actuated by and under the control of the governor, and at the same time the point of cut-off of the intermediate cylinder may be set at a fixed point independent of the governor if it is so desired, while for the large cylinder the point of cut-off is fixed by hand adjustment and always independent of the action of the governor, and thus a perfect means is afforded to adjust the ratio of expansion relatively in each cylinder, and effect the greatest possible economy of steam, and consequently fuel.

For the first and intermediate cylinders one eccentric is employed to operate their valve gear, and for the large cylinder one eccentric is used to operate the two steam valves, and one for the two exhaust valves.

The object and advantage of this arrangement being to obtain any amount of compression that may be found desirable independent of the action of the steam valve.

The diameter of the main driving wheel is 17 feet, and of 45 inch face, made in segments, and carrying a 44-inch double belt made by Messrs. C. A. Schieren & Co., of New York.

The jackets of the two receivers and of the three steam cylinders are drained by a pump three inches in diameter and 5-inch stroke, operated from the condenser of the engine, the water being pumped into the feed pipe.

The frame of the engine is one peculiar to the builders, and was first designed for heavy rolling-mill practice, and consists of strong wrought-iron bars or rods running from the cylinder head to the pillow block. The rods tie these two parts together, and at the same time form a part of the guide-rod for the horizontal cross-head. From each cross-head extend two hammered iron piston rods for the intermediate cylinder and large cylinder, and for the small cylinder one rod passes through the back head of the intermediate.

The speed of the engine is 100 revolutions per minute. To provide efficient lubrication for the main bearings, a positive oil circulation is produced by a pump operated from the valve-gear rocker shaft.

CONDENSER, ETC.

The condensing apparatus for the engines of the station will be arranged in series—*i. e.*, it will consist of several surface condensers and combined air and circulating pumps working upon one large exhaust main, which is common to all engines of the station.

This plan was adopted, after some deliberation, for the reason that any particular surface condenser, or a number of such, with its independent motive power for driving the pump of the same, can be operated at will, with the result of producing the desired vacuum upon the exhaust main. And as all of the engines are connected to this exhaust main, and are shut out at pleasure, therefore it follows that any individual engine is not restricted in its operation to the running of any condensing apparatus in the station.

Electric light stations, as we all know, are subject to wide variations in power during a period of 24 hours, and to economize power in the operation of the air and circulating pumps of the condensers, we have selected a cut-off engine as the motive power for the condensing apparatus; the point of cut-off of this engine being controlled by the vacuum in the surface condenser. As the load upon the main engines increases the volume of discharge from the air pumps. An opposite action results from a diminution of the load on the main engine, and correspondingly slows down the condensing engine.

The first condenser put in is nine feet long, six feet wide, and eight feet high, and contains 2,496 square feet of cooling surface. These tubes, which are $\frac{13}{16}$ inch, and $1\frac{1}{4}$ inches in diameter, placed one inside of the other, are suspended vertically from brass plates with their upper ends expanded therein. The plates for supporting the smaller tubes are some eight inches above those for the larger or cooling pipes, as per sheet 19.

These tubes are arranged in six sections of 208 pairs to a section, the water of condensation passing downward through the $\frac{13}{16}$-inch tubes, thence upward between the large and smaller tubes, where it then crosses over to the next section, passing downward through the large tube and upward through the smaller tubes, where it again passes forward, the operation being repeated until the water has traversed the six sections, when finally it passes overboard to the river by an 18-inch cast-iron pipe, whose end is submerged about four feet below low water and consequently acting as one leg of a siphon.

The injection pipe is laid in South street 200 feet south of the overflow, and commences at a well having three screen chambers leading therefrom to the river. The screens are covered with copper wire, $\frac{1}{4}$ inch and $\frac{3}{16}$ inch mesh.

The condensing apparatus engine is 12 inches diameter and 16 inches stroke, with liberating valve-gear and of the same pattern as the large engine. The air and salt water circulating pumps are respectively 24 inches and 16 inches diameter, each of 16 inches stroke.

Intermediate of the air and circulating pumps is located on the overhead crank shaft a plain fly-wheel 10 feet in diameter, the center of the shaft being 10 feet one inch above the floor. The condensing apparatus is shown on sheet 19.

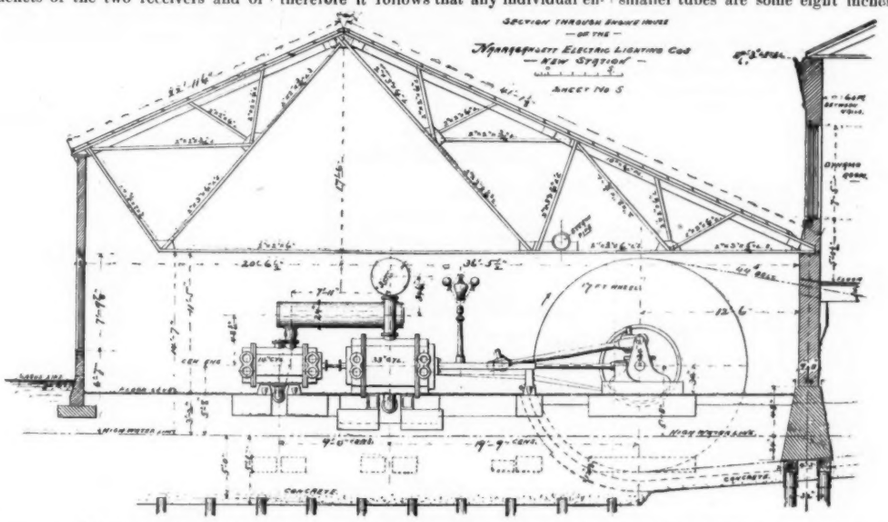
AUTOMATIC BOILER-FEEDING MCEHANISM.

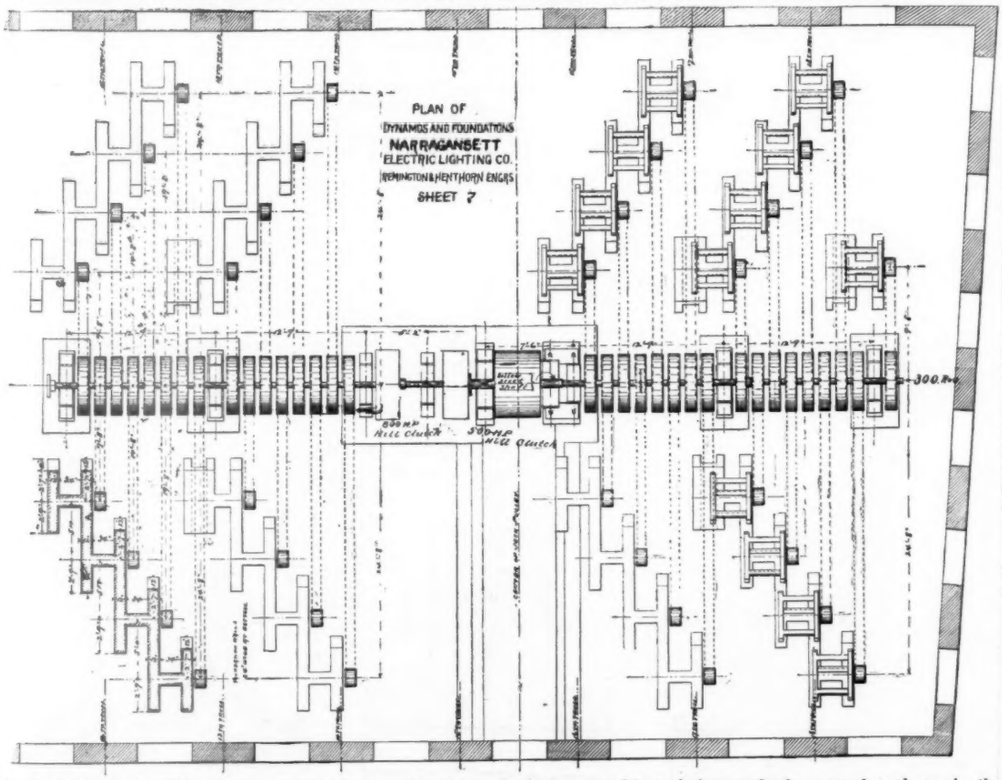
Upon the opposite end of the shaft of the condensing apparatus engine is located the feed pump. The pump has an automatic device for controlling its stroke by the height of the water in the boiler, and thus the stroke of the feed pump is automatically lengthened or shortened, as the case may be, to correspond with the actual quantity of water evaporated in the several boilers.

With this device we are enabled to run the pump at its full capacity, even though its stroke may be from 0 up to 16 inches, without the use of a "by pass," and thus at times save considerable power. This device consists of a float mounted in the boiler and operating a balance valve in the feed pipe line, which, by an increase in pressure in the feed pipe, due to an excessive height of water in the boiler, causes the closing of the balance valve. A reaction then takes place upon a differential water cylinder, and the movement due to this increase in pressure upon the piston contained therein shortens the stroke of the feed pump. A decrease in water level in the boilers has the effect of opening the balance valve of the feed pump wider, which momentarily has the effect to reduce the pressure therein, and this reaction upon the differential piston acts to lengthen the stroke of the feed pump, and consequently discharges more water, as required by the increased evaporation.

STEAM PIPE.

In a station of the proposed capacity of ours it becomes absolutely essential that the main line of steam pipe should be so constructed that full boiler pressure can be maintained upon it during every moment of





the year; and to avoid any possibilities of leakage that would prevent its use at any time, we have so arranged all joints in the main line that if any leakages should occur it may readily be remedied without removing the steam pressure therefrom.

The main line of pipe is 18 inches inside diameter, and was made from our designs by the Continental Iron Works, of Brooklyn, N. Y., and is of ½-inch steel plate, with the horizontal seams welded, while at the ends for connecting the various lengths together, a bell flange was turned out from the material of the pipe itself, as shown at sheet 11.

These flanges were then double riveted together, and the joint calked up against its neighboring flange from the outside. Where a wrought iron pipe joins a cast outlet or inlet tee, or to an elbow, they were likewise riveted to the cast iron flange, as shown, and the joint made tight by calking the bevel edge of the wrought iron flange against the cast iron. This also admits of recalking, should it become necessary at any time to do so, without removing the pressure from the pipe. The flange joints of all of the cast iron pipe in the main line are made with male and female joints, as shown, and into the recess of which is placed a gasket of vulcanized asbestos. The flanges are then bolted together with ⅞ inch bolts spaced about $4\frac{1}{16}$ inches center to center.

At each outlet and inlet, and directly upon the main line is placed an open way Chapman valve, having brass seats. The flanges of these valves are likewise provided with a male and female joint, so as to prevent any possibility of the joint blowing out.

The piping upon the main line, beyond these valves, is of orninary lap-welded tubes having screwed ends, fitting standard flanges and cast iron elbows. Should any section of this primary pipe leak at any time, it can be repaired by shutting it out by means of the valves above referred to, located in the main line.

The 18-inch main steam line will run along each side of the engine-room house, and at its extreme ends the two lines will join, and thus form a U for feeding all engines proposed for the station. Steam in the meantime is taken from the boilers into each end of the pipe.

Ample provisions are made for removing all water of condensation from the pipe, by collecting it into cast-iron wells having water glasses thereon, and then trapped into the feed-water tank, from whence it is pumped back into the boilers.

SHAFTING.

The engines are belted to jack pulleys secured upon open-hearth cast-steel hollow shafts, through which freely passes and revolves the six-inch hammered iron line shaft.

On one end of the hollow shaft is cast a head 24 inches in diameter, and to which is bolted a 54-inch Hill friction clutch, to transmit the power of the first engine of 500 horse-power.

As the hollow steel shaft is supported in bearings nine inches in diameter, and independent of the line shaft, it follows that the engine and its jack pulley, and of course the hollow shaft, can be stopped at pleasure by throwing out the friction clutch and still allow the main line to revolve as usual, but without touching the inside surface of the hollow shaft.

In case that the main line is in operation, and it is required to start up any engine, it is merely necessary to put the engine in operation and throw in the friction clutch, and consequently connect the whole firmly together.

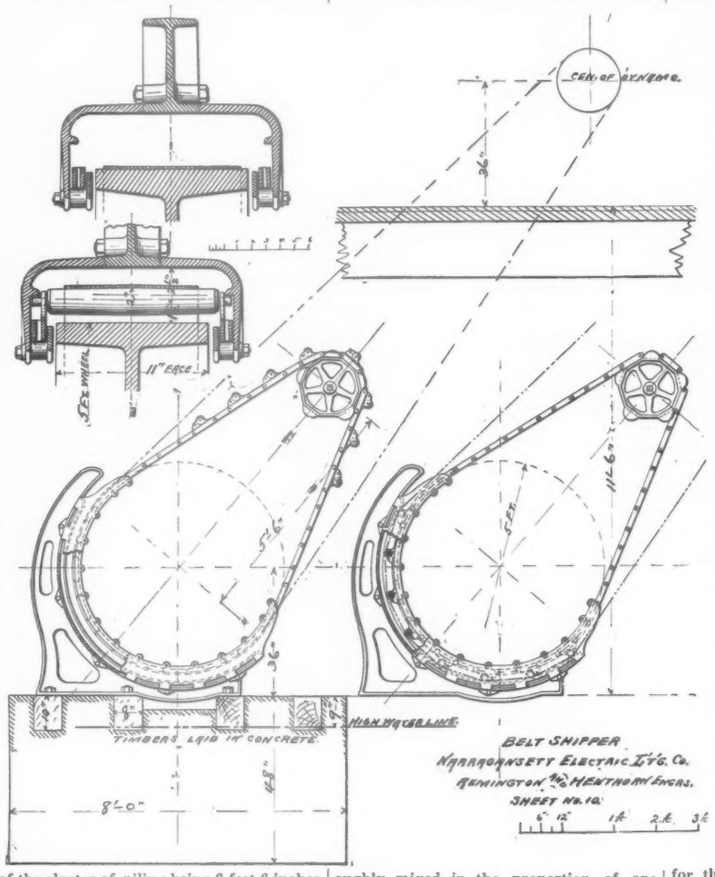
Alongside of the clutch upon the end of the hollow shaft is still another of 60 inches in diameter, and of 800 horse-power capacity. This clutch is provided so that the main line may be cut out at pleasure at that point.

All of the bearings in which the shafting revolves are of liberal length, and provided with bronze ring oilers, some having three rings, while others have but two. These rings encircle the shaft and revolve by contact therewith, thereby carrying a large quantity of oil from a chamber formed in the lower part of the pillow blocks, to the upper surface of the shafts, and thus provide ample lubrication, a feature very essential in view of the fact that the shafting is to run 300 revolutions per minute, and that the bearings, especially those of the hollow shafts, are of large diameter.

SEA WALL.

The most difficult portion of the foundations which was put in was experienced when we commenced that of the boiler-house wall upon the river front. This resulted from the fact that man had from time immemorial driven piles indiscriminately to replace those which had become worn out or broken under the several old wharves which had been in existence at this site.

When the former wharf, as we found it at the acquisition of the property, was removed, preliminary excavations were made, and an attempt made to remove the old piles found thereunder. During this operation the fact was revealed that the piles were of a miscellaneous diameter and of different length, none of them being sufficient for our purposes of building upon, some pulling out quite easily, while its neighbor would be broken in the attempt. This fact prompted us to drive all of the old piles thus left standing below the grade of the new ones which we wished to insert, and thus get the old piles beyond a point so that they would not interfere with our platform, which we proposed to place upon the head of the new piles. The piling upon this wall consisted of four rows, spaced 30 inches center to center, and parallel with the harbor line established by the city, the center



of the cluster of piling being 6 feet 6 inches from the established harbor line.

In addition to these four lines of piling, there was driven at every alternate row inland and at right angles to the harbor line a series of four piles spaced 4 feet 6 inches, 13 feet 6 inches, and 17 feet 3 inches, respectively, from the inner row of piles, as shown in section at sheet 12, and in plan at sheet 13. These piles, which were of spruce, and of 11 inches diameter at the butt and 54 to 50 feet long, were driven down with a ram of 2,200 pounds, and followed up at the last by a follower until hard bottom was reached, which varied from 45 to 53 feet below high water.

They were then cut off uniformly seven feet six inches below established high water mark by a circular saw hung up in the ways of the driver, and which was operated by the engine used for driving upon the floating scow. The number of new piles being 547. When this was accomplished, after the usual amount of damage to the several saws incident to the very frequent contacts with the stone ballast found below, the heads of the piles were then surmounted by 10x10 spruce timbers and securely fastened to the head of each new pile driven by ¾-inch drift-bolts. These timbers were alternately of 22 feet and eight feet six inches in length. And finally, upon these pile caps, were securely pinned and closely laid 6-inch spruce planks, which thus formed a platform 26 feet wide and extending the whole length of the river wall.

Inasmuch as there were already in place a large amount of old piles, 288 in number, which had been redriven below the line of the new, Portland cement concrete, thoroughly mixed in the proportion of one cement, two sand and one broken stone and gravel, was placed in bags and thoroughly rammed down between the new and upon the head of the old piles, and so left that when the 6-inch spruce planking was placed upon the stringers of the new piles, a bearing also would be had upon the old as well as upon the new, which is shown upon sheet 14.

Upon this timber platform, which runs inland from the river 26 feet, as above stated, was built the wall proper for the boiler-house and its surmounting coal pocket. The center of this wall, as we have before stated, is 6 feet 6 inches from the harbor line and the stone foundations, having a base of 8 feet, were started upon this platform and well bedded in cement; all bottom stones being laid as headers, and of 8 feet length. Above this the wall gradually tapered to 4 feet 9 inches in thickness at the 4-foot 8-inch level, this wall being laid up, as other foundation walls for the station, with cement mortar of one part of cement to two parts sand; the face of the wall being thoroughly pointed up 2½ inches deep with Portland cement.

This same construction of wall and four rows of piling was carried around the northeast corner of the house, as shown in elevation at sheet 15, as far as the platform extended to prevent any liability of washing from the river. From this point for the remaining portions of the walls the piles were driven in three rows, 16 inches center to center of caps, and spaced 42 inches lengthwise with the wall. These were cut off 84 inches below high water, and surmounted by a 12x12 hard pine stringer, as for the dynamo-house.

In sheet 14 a section of a portion of the north and the whole of the east wall is shown, its base being 4 feet 6 inches wide, tapering up to 3 feet 6 inches wide at the 4-foot level. These walls are laid up in cement, as for other underground sections.

BOILER-HOUSE.

The first section of boiler-house built is 68 feet long and 71 feet 10 inches wide, as shown on sheet 4, to accommodate four sections of boilers, and is so arranged that it may be lengthened the full width of the lot as required, or ultimately will be 200 feet long.

There are two rows of columns running lengthwise with the building, spaced 14 feet 3 inches, center to center, while across the house the center lines of the two rows are 21 feet. Under each column is driven a cluster of 15 piles to a depth of 45 feet to 53 feet below high water, and upon these are built the cut granite piers for supporting the coal pocket.

The piling for side walls and piers was carried about 15 feet beyond the actual line of the boiler house, so that when the party-wall is removed for extension the driving of additional piling will not disturb any of the permanent structures.

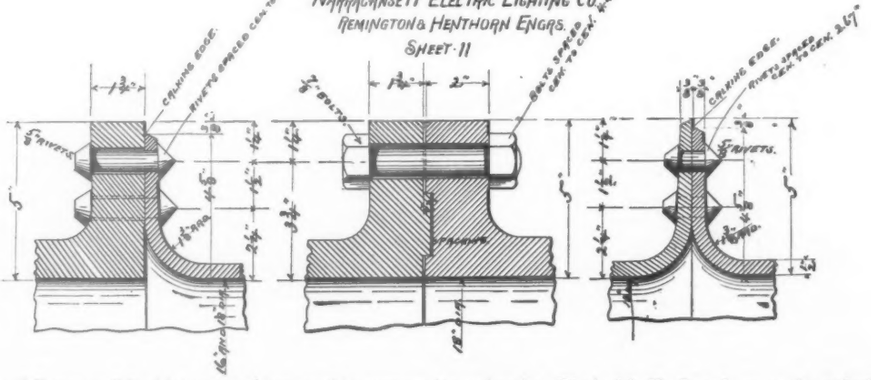
The walls of the house are 26 feet 1 inch above the floor, the first 5 feet 10 inches, being 36 inches thick, with granite underpinning and the balance of 32-inch wall. Lengthwise with the house is an ash tunnel 4 feet 6 inches wide and 6 inches 4 feet in the clear, in which is a tramway, and by means of a turn-table opposite each transverse tunnel leading directly under each boiler-grate, the carts for collecting the ashes are traversed back and forth as they become filled.

Directly over the boilers will be stored the fuel for the station in a wrought iron coal pocket 25 feet in depth, and of a capacity for this first section of 2,500 tons. Being directly upon tidewater, the coal is taken from the vessel alongside of the building, and is landed at once to any section of the pocket. The coal, after being weighed in a movable machine, is deposited opposite the furnace doors by gravity. The floor of the pocket being built on an incline to facilitate the discharge of the coal.

BOILERS.

The first section of 500 horse-power boilers for the station were made by the National Water-Tube Boiler Company, of New Brunswick, N. J., and are, as the maker's name implies, of the water-tube type. They are set in two batteries to a section, each of which are of 250 horse-power, upon the commercial basis of 30 pounds of water evaporated into dry steam per hour; and, as the engine is guaranteed to develop an indicated horse-power for 12.6 pounds of water per hour, the boilers will therefore evaporate water enough to develop by the engine about 1,100 horse-power per section.

Each boiler of the section is made up of 144 steel tubes four inches in diameter and



16 feet long, the tubes terminating into charcoal iron cast headers lying horizontally. These several layers of headers are nippled together with 4½-inch steel tubes, and are finally connected to the saddles by 5-inch nipples. Upon the top of each boiler of the section are placed three 36-inch steam and water drums, made up of $\frac{7}{16}$-inch steel plate, to the lower side of which, at its extreme ends, are riveted the up and down take saddles which receive the end of the 5-inch rear down take tubes, and at the forward end the 5-inch nipples before described, which are expanded into the upper row of horizontal headers. Inside and outside hand-holes are provided opposite the ends of each tube, the former for preventing serious accident to those in charge of the boilers in case of the breakage of a hand-hole plate bolt, and the latter for providing the necessary water-tight joint.

The length of the grates under each boiler is 6 feet, and the width of the furnace 9 feet, and were designed for the ultimate introduction of a mechanical stoker of some improved pattern when the next series of boilers are placed in position.

Underneath each section of grates and below the level of the boiler-house floor is a pit or tunnel, as before stated, in which is a tramway for conveying the ash and clinkers collected in a car provided for that purpose, and by means of a turn-table the car is transferred to the longitudinal pit or tunnel located at the center of the boiler-house, from whence it is propelled to the street, and finally hoisted by power into the cart for conveying it away.

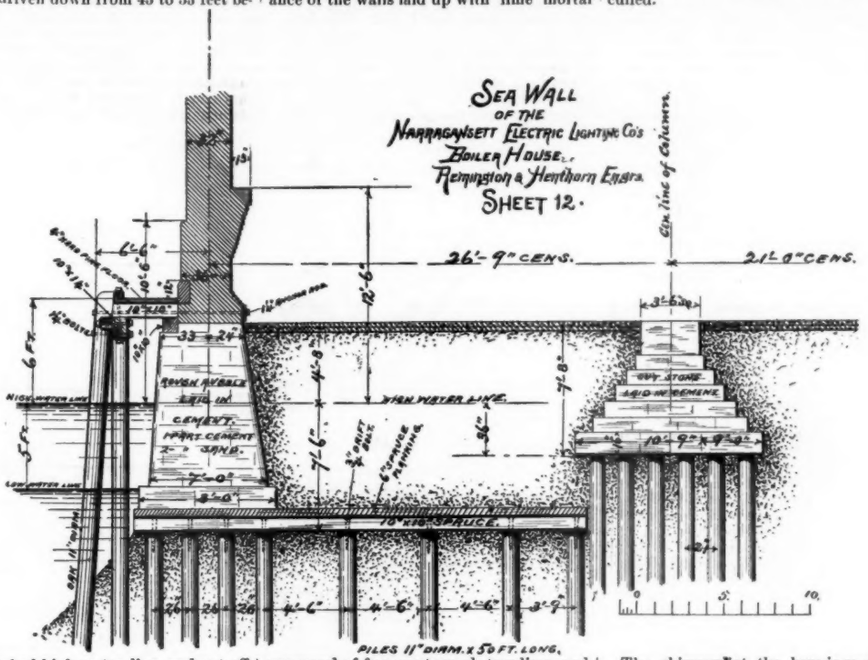
This system of tunnels is plainly shown at sheet No. 4.

ECONOMIZER.

At the rear of the boilers, and common to each section of two boilers, is placed vertically a Green economizer, having 192 4-inch cast iron tubes, each 10 feet long. The flues leading to the economizers are so arranged, as will be seen by referring to sheet 4, that the gases may be diverted by dampers through the economizer, or into the underneath direct flue leading to the chimney, at will.

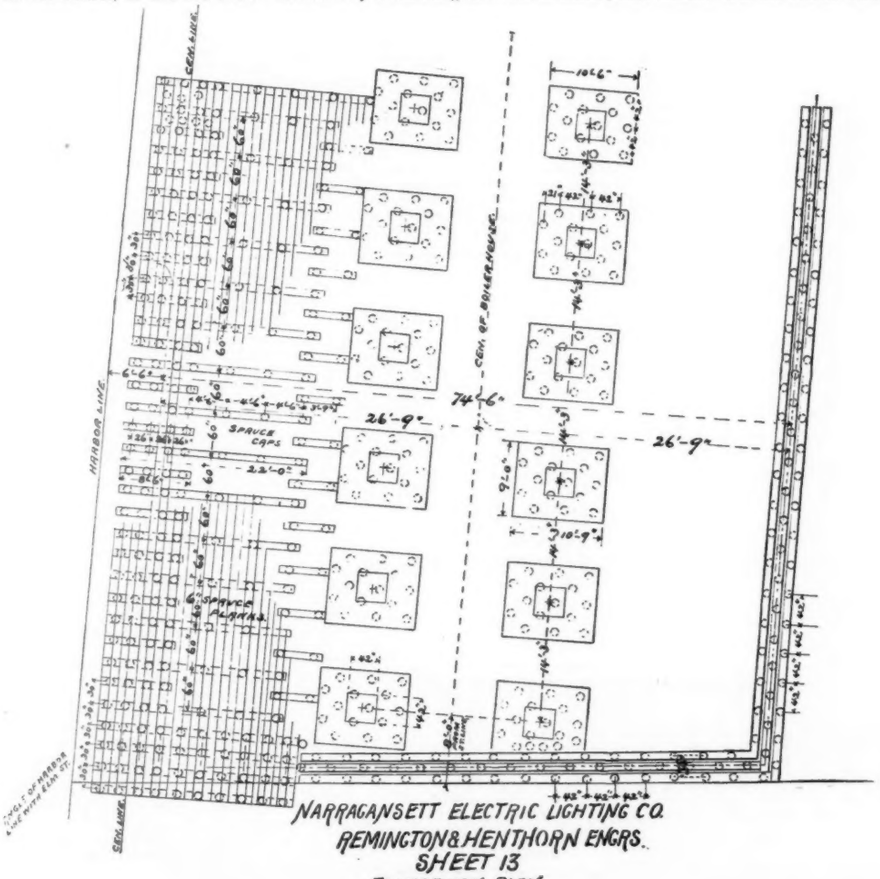
CHIMNEY.

The chimney, which is 14 feet interior diameter, and when completed will be 238 feet in height above zero level, is located midway between the two streets, and about 125 feet from the river line, and is surrounded by the engine-room. The foundation is composed of 405 spruce piles, as per sheet 18, driven down from 45 to 53 feet below esta b'shed high water line, and cut off 5 feet below this line, and upon these, encased in sheet piling, is a bed of concrete 44 feet wide by 59 feet long and 6 feet 9 inches deep, thus forming a block of 16,000 cubic feet, and weighing about 2,000,000 pounds, which is composed of one part of Norton's hydraulic cement, two parts sand and three parts broken stone. Upon this bed was started the brick work, 36 feet square.



The first 5 feet of the walls are laid up in the proportion of one cement to one sand, above that, and up to the 85 foot level the proportion being one to two, and the balance of the walls laid up with lime mortar composed of four parts sand, two lime and one cement. All surfaces of the core or flue that are exposed to the heat are laid up with lime mortar. For the outside walls, as for the other buildings, red soapstone finish mortar was used, which becomes very hard after a short exposure or when dry.

The brick used was a quality especially burned for us by a local company, our only requirement being that all of them should be extremely hard and tough, without regard to color or size, and from the large quantity of brick required for the work, ample good colors for the outside work are readily culled.



The chimney at the base is made up of three walls, the outer being 28 inches thick, the intermediate 12 inches, and the core or the flew 16 inches. The intermediate wall is octagonal in cross-section and surrounding the core or flue, which has an internal diameter of 14 feet. The outer and intermediate walls are joined together by 8 buttresses, both being carried up at the same time, and thus thoroughly bonded together. Eight inside buttresses also extend to within one inch of the outside of the flue wall, and are carried up to its extreme height.

The cross sections at the several elevations being represented by sheet 17.

As the intermediate walls are carried up plumb and the 2.8 inch outside wall has a batter of 2.8 inches in 10 feet, they finally intersect at the 90-foot level, and from that point the walls are gradually reduced to 20 inches in thickness, thence to 16 inches, and finally 12 inches at the commencement of the enlargement for the cap.

At the 38-foot 2-inch level a series of granite stone are placed in each corner of the square; the same are so cut that the form of the chimney is changed to an octagonal cross section at the 46-foot 2-inch level, and that form is thereafter maintained. From this 46-foot 2-inch level, at each corner of the octagonal, are pilasters 24 inches wide and projecting 4 inches from the surface of the wall.

The flue or core of the chimney has a 16-inch wall, as above referred to, and is reduced at the 78-foot 2-inch level to 12 inches, and again at the 163-foot 2-inch level to 8 inches, and is thus continued up to within 4 feet of the top.

At the bottom of the chimney means are provided, by arched openings through the various walls, for access to all spaces in the base for cleaning, etc. These passage ways in the intermediate wall, by ascending vertical ladders built into the outer and intermediate walls for that purpose, also afford access to the damper bearings which are on the 37-foot 2-inch level.

The damper is made up of two sections, each hung at an angle of 30 degrees from a horizontal line, so that by rotating each 60 degrees the two extremes of their motion will be reached.

Each half of leaf of the damper is composed of six sections of ¾-inch cast iron plates, having flanges thereon for bolting together, and through which passes a 2-inch by 2-inch wrought iron spindle or shaft, the ends of which are turned down to 1¾ inches in diameter, which rotate on the anti-friction pulleys 8⅜ inches in diameter. The levers for operating the dampers are located between the outer and intermediate walls, and the connections therefrom pass downward, thence through the wall and finally outside of the chimney, where they are acted upon by the damper regulator.

This unusual course was provided so that all of the connections would be protected from the weather, as the dampers themselves are above the roof of the engine house.

The cap surmounting the chimney is of an octagonal form for the cone as well as the outside, and is made up of 16 sections bolted together with copper bolts; in the recess formed between each joint is calked two layers of one-eighth inch copper wire for

the purpose of forming a water-tight joint, and thus protect the underlying brick work, and at the same time forming a metallic contact between the several sections of the cap and also serving as a guard against lightning. To the cap proper is secured by copper bolts a cast iron cresting of plain design and of about 5 feet in height, and which also forms part of the lightning conductor. The absolute metallic contact between all sections of the cap and cresting prompted the connection therewith of the 1½x⅛ inch copper rod, which terminates at its lower end, to a 16-inch cast iron water pipe running to the river, and consequently always submerged, leads us to believe that all possible provisions have been made for this erratic, uncontrollable, alternating current.

Between the intermediate wall and the flue is built in a ladder formed of 1¼-inch round iron, one end of which, being built solid into the intermediate wall, while the other end is left free to accommodate itself to the expansion of the flue. This ladder is located a short distance from the angle of the octagonal, and is carried plumb the whole length of the flue.

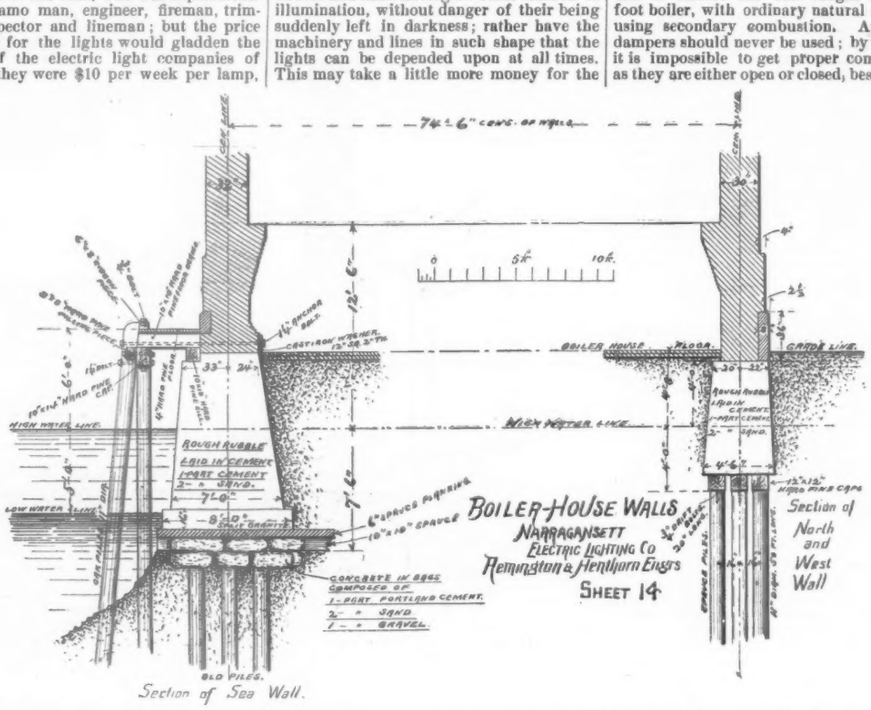
Directly above and below the opening for the smoke flue, which is 10 feet wide and 18 feet high, is built into the outside wall and 8 inches from the outside thereof, two 1¼ rods, the ends of which are 1½ inches in diameter, and secured to a heavy cast-iron plate. Above these are built in every 20 feet, 4x1½ inch and 3x1½ inch bar-iron laid edgewise, which, when bolted together, forms an octagonal of sufficient size to extend to within 8 inches of each side of the chimney. The last of these bar-iron braces are placed at the 153-foot 2-inch level.

The method of construction is of a very simple nature. At the commencement a 12x12 inch cast-iron plate, having thereon a center or bench mark, was placed in the center of the chimney, and from that center mark the axis of the chimney is re-established every 20 feet throughout its height.

All materials used in construction was conveyed to the top by an elevator having a platform 4 feet by 4 feet, arranged to run up and down inside of the shaft, and guided at opposite corners by 6x6 inch hard pine vertical timbers, which also serve for the gripping device to act upon in case of accident to the manilla cable. As the work progresses, the upper framework, carrying the overhead 30-inch shieve, is hoisted up and new framework added directly below. At the same time interior scaffolds were built in every 5 feet and secured by 6x8 inch timbers placed in the wall.

There will be used in its construction 1,500,000 bricks.

In conclusion, we desire to place on record the fact that the development and phenomenal success of this company, which started but 5 years ago with 29 lights, and the inception of this new station, marking an advance in this field of engineering, is due to the broad and comprehensive labors and achievements of Marsden J. Perry, Esq., vice-president and general manager, a gentleman of sound business abilities, readily grasping engineering details, and fully appreciating the axiom that the "best is the cheapest" in the end.


74'-6" CENS. OF WALLS
BOILER HOUSE FLOOR
GRADE LINE
HIGH WATER LINE
LOW WATER LINE
ROUGH RUBBLE LAID IN CEMENT MORTAR CEMENT 2 - SAND 7 - 0
6" SPRUCE PLANKING
CONCRETE IN BAGS COMPOSED OF 1 - PART PORTLAND CEMENT 3 - " SAND 7 - " GRAVEL
OLD PILES.
BOILER-HOUSE WALLS
NARRAGANSETT ELECTRIC LIGHTING CO
Remington & Hentburn Engrs
SHEET 14
Section of North and West Wall

Section of Sea Wall.

THE PERFECT ARC CENTRAL STATION.

BY M. D. LAW.

READ BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, AT NIAGARA FALLS, AUGUST 6TH, 1889.

It has usually been more the rule than the exception that electric light central stations have been located in almost any place that could be had; some old shell of a building would be used, that would have nothing to recommend it except that it was cheap.

In fact, the first station for central lighting purposes was started in San Francisco in a blacksmith's shop, using an old, worn-out portable engine and boiler. The force consisted of one man, who was superintendent, dynamo man, engineer, fireman, trimmer, inspector and lineman; but the price received for the lights would gladden the hearts of the electric light companies of to-day; they were $10 per week per lamp, and burned from dusk to midnight, except Sundays. And when I look back to that time of running arc lamps on one wire, with ground return, I am amazed that there were so few troubles in the shape of grounds and fires. Not only was a ground return used, but inside wiring was thought good enough when put up without any insulation, but fastened with wire staples.

There are a great many places even now where bare wires are stapled fast, showing the absolute need of good, competent, fearless inspectors, who will examine every inch of wire in a building, and not be afraid to condemn it if it does not come up to the requirements of safety. Then, again, all inside wiring should be inspected at least once a month.

An electric lighting station should be located as near the center of the territory to be lighted as possible, but if sufficient ground cannot be obtained at a reasonable cost, then it is better to go a little to one side rather than be crowded for room; for when an electric lighting station is cramped for room it cannot be handled with economy, as one of the greatest successes of central station work is not only in the simple running of the machinery well, but when troubles occur in the shape of breakdowns (which are liable to happen in the best regulated station), there should be sufficient room to move the machinery without taking too much time. In such a case time is money, for the amount of money allowed in rebates is only a small fraction of the loss, as the reputation of never having the lights out is worth much more than their mere money value. For electric lights are not a success until they can be placed in business houses and halls having no other method of illumination, without danger of their being suddenly left in darkness; rather have the machinery and lines in such shape that the lights can be depended upon at all times. This may take a little more money for the construction of the plant, but it will be more than made up in the commercial value of the lights.

An electric lighting station should be built of brick or stone, in a neat, substantial manner, not more than two stories high, and be as near fire-proof as possible. One of the important factors of such a station is good ventilation, it being necessary to keep engines, shafting and dynamos as cool as possible. This not only adds to their life, but their over-heating is a great element of danger to the success of the lights.

BOILER ROOMS AND BOILERS.

The boiler room should be located on the ground floor, with plenty of ventilation, making the fire room cool and comfortable. Everything being in full view and easy of access, can be kept clean and in order.

In constructing an electric light station, the dynamos and engines are generally placed first, and what room is left the boilers are thrown into, without much regard to their economical handling. It is better to have a comfortable fire room, as the firemen can then remain by the boilers, doing justice to their work. By having boilers in cellars, cramped, or poorly lighted and ventilated places, makes the men careless, and also detracts from the life of the boilers by corrosion and improper care.

It is found that two-thirds of the steam which is generated in a tubular boiler is made on the shell, and not in the boiler tubes, as supposed. In taking the heating surface of the boiler tubes we should only take one-half of the circumference, as the flame only impinges on the upper half of the tubes. With proper setting, flame can be carried the full length of a 30-foot boiler, with ordinary natural draught, using secondary combustion. Automatic dampers should never be used; by their use it is impossible to get proper combustion, as they are either open or closed, besides having the tendency to make firemen careless. An ordinary fireman, with hand dampers, can fire with not over two pounds variation of steam in a run of twelve hours. When the boilers are working to within three to five pounds of their utmost capacity, the hand dampers are kept partly open, and as the steam varies the damper is changed to suit, therefore always allowing of proper combustion.

For a 1,000 light station there should be 12 single tubular boilers, 48 inches in diameter and 20 feet long, with 22 5-inch tubes, the shell to be made of ⅜ inch steel or iron, having a tensile strength of 55,000 pounds and 25 per cent. ductility in eight inches.

Double riveted longitudinal seams and first class workmanship will stand a safe working pressure of 130 pounds per square inch, which will give 1,325 horse-power. With the Corliss type of engine, carrying 110 pounds per square inch, there would therefore be three boilers which could be held in reserve, that being none too many for safety, and the other nine boilers can be worked very easily, as rapid combustion is the most economical.

ENGINES.

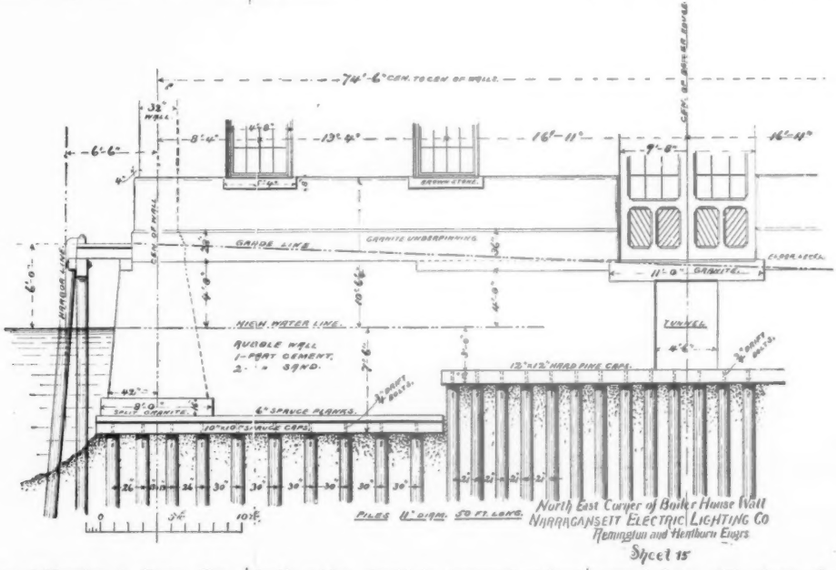
Electric lighting is one of the hardest kinds of work for a steam engine, the continuous running and the work being thrown on and off instantaneously causing immense strains.

They should be twin engines, connected at right angles, by which we have steadier power than with single engines, because we have the impulse of the steam at every quarter of a revolution. They should be built specially and have a larger amount of iron in all their parts than is used in an ordinary commercial engine, so that in times of trouble they can be forced for a short time beyond their ordinary load.

For a 1,000-light station there should be two 23x48-inch twin engines, running at a speed of from 70 to 80 revolutions. With this number and size of an engine there will be a reserve of one engine, as the three engines will easily carry the load of 1,000 lights with economy.

It is a settled fact that the Corliss type of non-condensing engines, properly constructed and handled, are the most economical, using less than two and one-half pounds of coal per horse-power, working at 110 to 115 pounds of steam per square inch. High rotative speed is not necessary for electric lighting, but it does require a steady and uniform speed. An engine running 40 revolutions per minute, provided the speed is regular, will make as good lights as one running 300 revolutions.

It has been practically demonstrated in a great number of plants, which have used the small, high rotative speed engines, that such is the fact, the low speed using less coal, oil and attention, while the cost for repairs is


74'-6" CEN. TO CEN. OF WALL
GRADE LINE
GRANITE UNDERPINNING
HIGH WATER LINE
RUBBLE WALL 1 - PART CEMENT 2 - " SAND
6" SPRUCE PLANKS
12"x12" HARD PINE CAPS
TUNNEL
FLOOR LEVEL
PILES 11" DIAM. 50 FT. LONG
North East Corner of Boiler House Wall
NARRAGANSETT ELECTRIC LIGHTING CO
Remington and Hentburn Engrs
Sheet 15

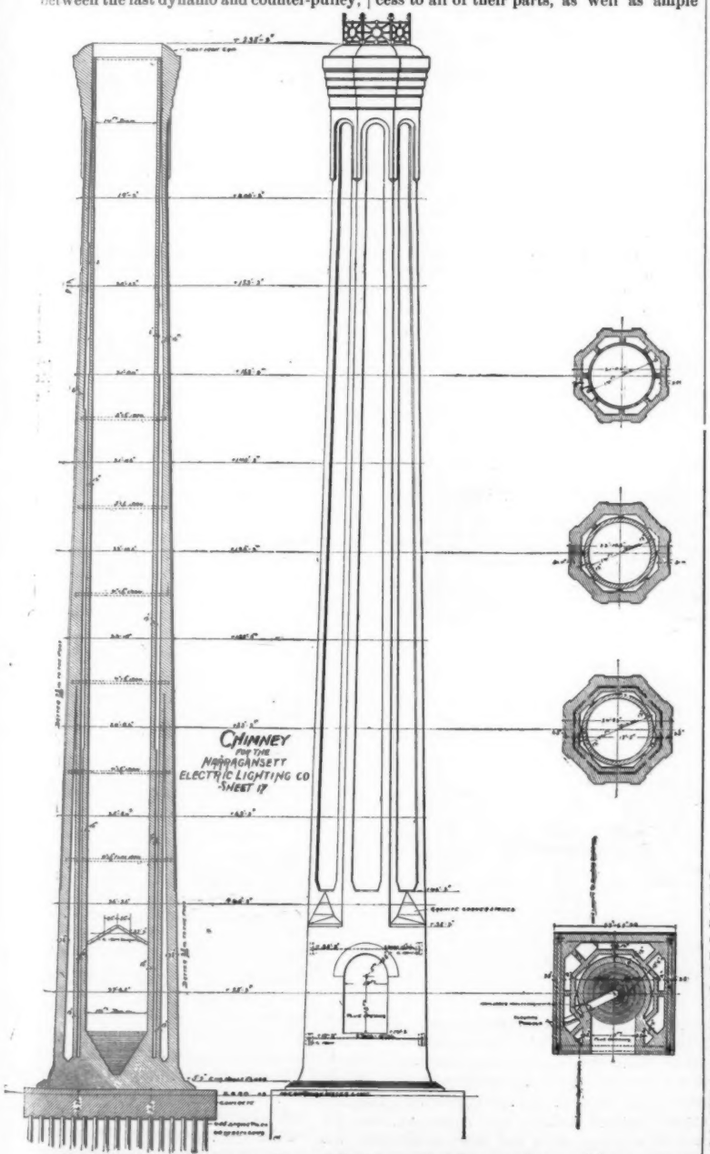
very much less, as well as loss of steam from radiation, clearances, etc., than high-speed engines. On a pair of Corliss engines 28x48 inches, at 75 revolutions per minute, running day and night for nearly seven years, the actual cost for repairs was but $25, and during that time they were shut down but once on account of breakage, and then only 10 minutes to disconnect one engine, the other being run with the load of both at increased steam pressure.

SHAFTING.

The friction of a high rotative speed engine and a 60-light dynamo is 6 indicated horse-power, while the friction of one pair of engines, shafting, 22 empty dynamos, 11 idlers and 22 Hill clutch pulleys, 5 feet in diameter and 12-inch face is but 72 indicated horse-power, both running up to speed. The only argument against large engines is that in case of breakage it stops the whole plant, whereas in a series of small engines, connected direct, it will stop but one dynamo.

In all cases shafting should be made of hammered iron, and for a 1,000-light station the main line should be 75 feet long and 6 inches in diameter, and about 55 feet of counter shaft, commencing at 5 inches diameter and reducing one-half an inch for every two machines, to be located on the ground floor, with pedestals as low as possible and bearings of cast iron, not less than four to one. The main bearings ought to be of phosphor bronze, and the shafting run not less than 300 revolutions per minute. The expense of oil on such a shaft, with proper appliances, will not be over $3 per year.

The driven pulleys from the engines should be on the two ends of the main line of the shaft, with a clutch cut-off between one engine and the first dynamo pulley, one between the last dynamo and counter-pulley,



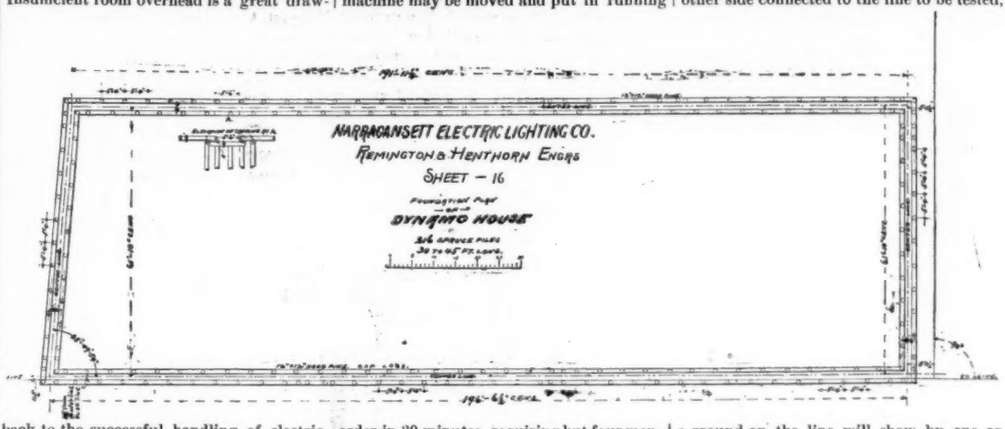
and one between the counter pulley and the other engine, with a clutch on the counter pulley. This will give perfect control of the main shaft and counter shaft, and can either run one or both engines, as the load may require.

DYNAMOS.

The dynamo room should be directly over the shaft lines, so as to use angle belts. The light should be good, and the ventilation perfect. The roof should be supported without posts and be of sufficient height so that the dynamos or armature can be hoisted and carried over the ones that are running. Insufficient room overhead is a great drawback to the successful handling of electric light machinery.

The dynamos should be small and mounted on cast-iron beds, left entirely open to allow perfect cleaning, as the life of dynamos depends very much upon their cleanliness. They should be placed in rows, with sufficient space between them to allow easy access to all of their parts, as well as ample room, that they may be moved from one part of the room to another without disturbing those that are running.

If the roof cannot be made sufficiently strong to support the combined weight of dynamo and armature on a track, then a good substitute is a frame supported on large casters, with a track over the top, having on it a chain-geared trolley and a chain hoist. This will allow of the rapid lifting of the dynamo, its moving to some other place, rolling the hoisting frame to that place, and putting the dynamo in proper position for running. With this arrangement a 3-ton machine may be moved and put in running order in 30 minutes, requiring but four men; with a little longer time two men will do the same work.



A cupola should be provided, not smaller than 10 by 30 feet, and 10 feet high, with window ventilators extending the full length of the two sides, and so arranged as to be under the full control of the machine man. With such a cupola, one is enabled to put the lines in good shape, as well as to carry off a large amount of heat. The wires should run to the switchboard from binding posts placed through the center of the cupola, and all crossing of lines should be made at this point.

SWITCHBOARD.

The switchboard should be placed in the middle of one side of the dynamo room, and four feet from the wall, and should be at least 25 feet long, which will give room for 50 circuits. As it is impossible to keep all circuits built up to the full capacity of the machine, it is well to have a number of small circuits to couple in, in order to build up to the full machine capacity, as all dynamos work more economically with a full load.

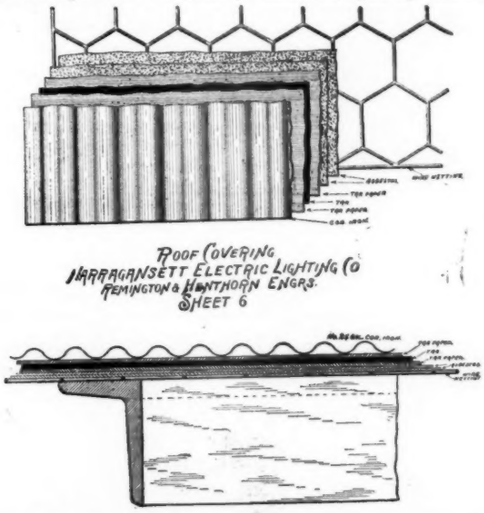
The line wires should come into spring jacks which are arranged in two rows, with one side of the circuit on top and the other below, with eight inches of space between them, so that there is no possible danger of a person being liable to touch or short-circuit two of them. Before attaching to the spring jack, one side of the circuit should pass through an indicator for showing the direction of the current. The wires from the dynamos should be run beneath the floor, coming up on the back of the switchboard, and enter binding posts, to which a flexible cable should be attached, having a wooden-handled plug for entering the spring jack; these cables should be of sufficient length to reach either end of the switchboard. The spring jacks and binding posts of the machine cable should be so arranged that a connection cable can be hooked on for the purpose of moving the machine cable from one circuit to another, to cut-out or cut-in circuits, without extinguishing the lights already burning. The positive wire coming from the dynamo should pass through an ammeter before entering its binding posts.

A good arrangement for making ground tests and locating grounds while lights are burning is a set of thirty 92-volt incandescent lamps in series, so arranged with a circular switch that any number may be short-circuited at will. With one side of this lamp circuit connected to ground and the other side connected to the line to be tested, a ground on the line will show by one or more of the amps burning.

I find that with one lamp burning, on, say, the positive side of the test circuit, with an electro-motive force of 92 volts, the ground may be looked for between the second and third arc lamp on that side of the circuit; in fact, each 92-volt lamp will represent two arc lamps or their equivalent in line wire resistance. This is a simple and handy method of locating grounds, especially if the positive and negative side of the circuit are much separated, for it starts one out on the right end of the wire, which is rarely the case without any reliable method of testing. When two grounds occur at night, cutting out a number of lights, it is necessary to be able to start out with some knowledge of its locality, especially if such a circuit is from 12 to 15 miles long, and starting out from one point of the compass and returning by another.

If there is an indication that the full number of arc lamps are not burning on a circuit, by attaching one side of this test to the positive and the other to the negative spring jack of the circut in doubt, it will show within one or two lamps of the number that are burning.

Ammeters, lightning arresters, indicators and all connections should be placed on the switchboard.



LINES.

Lines in all cases should be supported on glass or porcelain throughout their whole length, and should never enter a building without passing through hard rubber tubing with water drips on the outside. In all cases, inside wires should be run on glass or porcelain insulators; moldings or cleats should never be used for arc light wires, and in no case should they be put under floors or out of sight.

All arc lamps should be hung on porcelain insulators, and in the case of outside lamps all iron should be galvanized to prevent the rust from collecting on the insulators, which gives a first-class ground, if the fixture connects to tin gutters or iron work.

All lines should be tested for grounds at least three times during the day, and once every hour while the lights are burning; as soon as a ground occurs it should be immediately found and cleared.

STORE ROOM.

The store room should be of good size

and provided with cupboards, drawers and shelves, that a full line of all supplies can be kept on hand and issued only on requisitions from foreman of construction gang. When a job is completed a return should be made of the material returned and the charge entered in the proper books.

A carbon book should be kept in which each trimmer signs a receipt for the carbons issued each day, as the trimmer reports each day the number of carbons used on his route. The stumps returned must accord with the report at the end of the week; he must account for the number of carbons on hand or pay for them. The trimmer will only pay for one lot of lost or broken carbons, as he finds it easier to take care of carbons than buy them.

SHOP.

The shop should be of good size and provided with at least one 12-inch lathe, drill press and buffing wheel, with sufficient small tools for all kinds of repairing and the manufacturing of switches, fixtures, insulators, and all the thousand-and-one articles that come up for use in such a station.

The test rack should be located in the shop and be large enough to hold at least four lamps, each lamp to be provided with an adjustable lens for focusing the arc of a lamp on a screen; this affords a good opportunity of closely watching the arc without injury to the eyes, and has a capacity of from seven to ten lamps per day.

Troy's Electric Motor Cars.

This week, at the Gilbert car works, Green Island, will be completed two handsome cars, to be used on the new electric road of the Troy and Lansingburgh Street Railroad Company. The cars are finished in the main of mahogany, and will be a trifle longer than the ordinary cars drawn by horse power. The front of both platforms will be of glass, with windows that can be raised or lowered. The new patent racket brake is similar to a lever, and is pulled back and forward as the occasion requires. If they give satisfaction more cars will be ordered.

The National Pipe Bending Company, of New Haven, Ct., manufacturers of the National Feed Water Heater, report the sale of 55 heaters during the month of July, including one 300 h. p. to Whitehall, Pa., one 150 h. p. to Auburn, Me., one 300 h. p. to Stamford, Ct., one 150 h. p. to Charlotte, N. C., one 400 h. p. to Hudson, N. Y., one 200 h. p. to the Anthracite Electric Co., Pottsville, Pa., one 300 h. p. to Bracken, N. C., one 100 h. p. to Americus, Ga., one 100 h. p. to Social Circle, Ga., and one 400 h. p. to the Fulton County Street Railway Company, Atlanta, Ga. They have orders for a number of large heaters for electric light plants, including one of 800 h. p. capacity.

* * Mr. Geo. H. Bliss, of the Dubuque, Ia., Electric Motor Company, has secured a promise that his rails would be rolled speedily at Johnstown, Pa. He hopes to have the line in operation by September 1

Electrical Phenomenon.

S. Lewis Cramer, superintendent of the Pottstown (Pa.) Gas Company, while fishing in Gabel's mill race, near the gas works, witnessed an astonishing spectacle and made a narrow escape. A storm was approaching, from which a few drops were falling, when suddenly a large electric ball, apparently 16 inches in diameter, sped down from the thundercloud and burst with a terrific report within 25 feet of the startled angler, and six or seven feet from the ground, scattering into what seemed millions of fragments and sparks. Cramer was, for the moment, severely stunned—then, recovering himself, seized his fishing tackle and fled. The phenomenon was a grand one, such as the gentleman who saw it would like to witness again at a greater distance. The detonation or thunderclap almost shook the town. The subsequent storm was very heavy.

Where Electricity Saves.

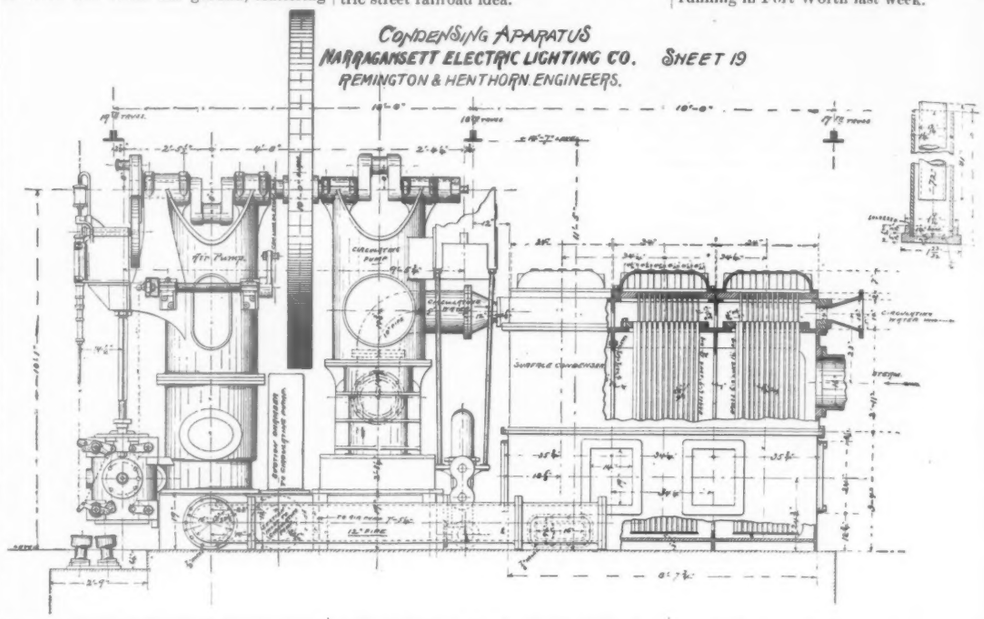
By the Thomson electric process of welding, the rails of street or steam railways can be welded together, it is said, after being placed in position. A dynamo propels over the track an electric welding machine, which welds the rails into one continuous line as it passes over them. It is proposed to have at every 300 feet a break, to allow for expansion and contraction. President Whitney is reported as saying that the application of this invention to the West End system will save the company an immense amount per annum. Any kind of rails can be thus welded, and on the West End lines power can be obtained from the wires now in use, with but a 500 voltage.

* * The Brush Electric Company proposes to build an electric railway in Belden avenue, Cleveland.

* * The Memphis *Appeal* says indications point to an early introduction of electric power in that city.

* * Franklin, Pa., not to be outdone by Oil City, is becoming infected with the electric street railroad idea.

* * The first electric car in Texas began running in Fort Worth last week.



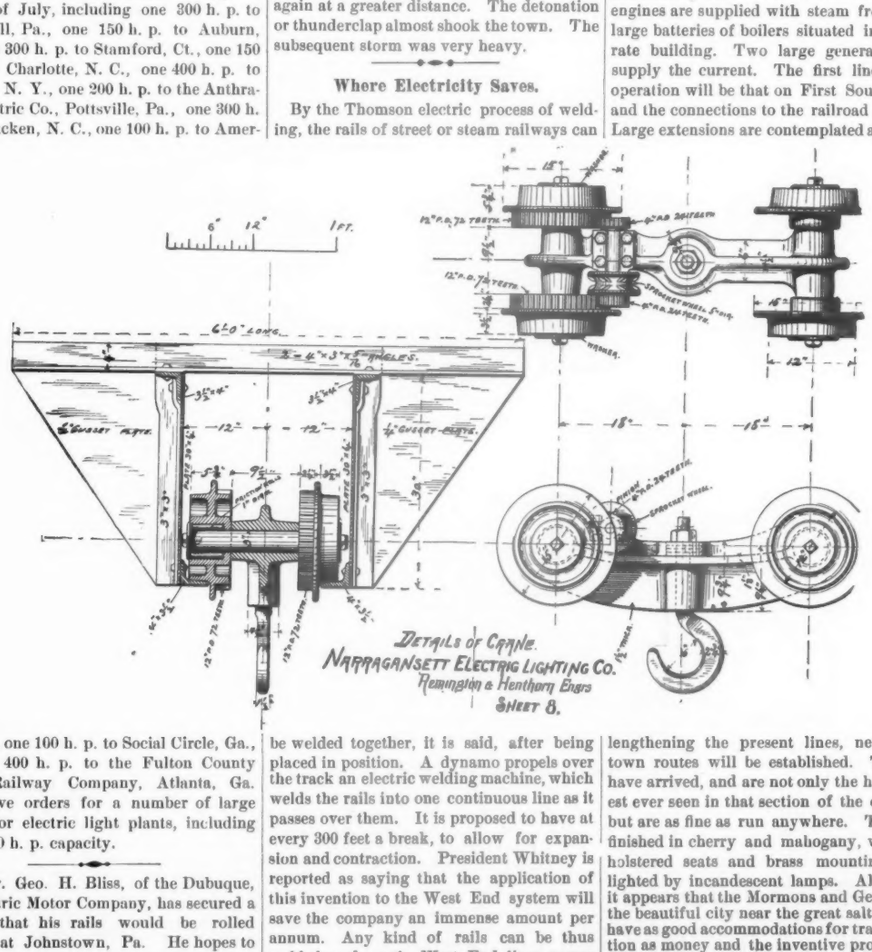
Electric Road in Utah's Metropolis.

The Salt Lake City, Utah, power plant for the electric road is in an 80x40 building on Second East street, and consists of two 300-horse power engines, between which is an immense fly wheel 14 feet in diameter. The engines are supplied with steam from three large batteries of boilers situated in a separate building. Two large generators will supply the current. The first line put in operation will be that on First South street and the connections to the railroad stations. Large extensions are contemplated and, after lengthening the present lines, new cross town routes will be established. The cars have arrived, and are not only the handsomest ever seen in that section of the country, but are as fine as run anywhere. They are finished in cherry and mahogany, with upholstered seats and brass mountings and lighted by incandescent lamps. Altogether it appears that the Mormons and Gentiles of the beautiful city near the great salt sea will have as good accommodations for transportation as money and the inventive progress of the age can secure.

* * Winston, N. C., is about adopting electricity as a motive power for the street cars.

* * Ninety-five men are at work in Richmond, Ind., tearing up the old street railway track throughout the city, preparatory to putting down new rails on which to run new cars by electricity.

* * The motive-power of the Union Depot Railroad Company, of St. Louis, Mo., from Twelfth street and Chouteau avenue to the southwestern part of the city, will be changed to electricity within the next three or four months.



Mr. Brown and his Torture Machine.

[From the Rochester *Democrat.*]

Mr. Harold P. Brown is now in Auburn prison with his patent electrical device for killing murderers. He is to conduct a series of experiments upon animals, and thus proposes to demonstrate his ability to kill men. There will be nothing new revealed by his experiments, and their worthlessness has already been thoroughly exposed by the testimony in the Kemmler investigation; but Brown seems as much enamored of his machine as a boy with a new top. The whole matter is intensely repulsive in its crudity and cruelty.

Electrical Execution and the Executioner.

[From the New York *Sun.*]

The convention of electricians at Niagara Falls not only passed resolutions calling for the repeal of the law establishing execution by electricity, but they also appointed a committee to present them to Governor Hill, and to oppose the new method of capital punishment as cruel and purely experimental. Those who know most as to the practical workings of electricity are most decided in their opinion that it should not be used as the means of inflicting the death penalty.

There are electricians of distinction, though the profession, as a distinct one, has had its beginning within recent years only; but by far the most notorious of electricians will be Harold P. Brown if he makes his experiment with Kemmler. He will be known throughout the civilized world as Executioner Brown. No other man in the profession envies him the chance.